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CONTENTS:

- Notes on Oklahoma Plants. *Milton Hopkins and U. T. Waterfall* 113
- Fruit of *Dirca palustris*. *M. L. Fernald* 117
- The Broad-leaved Species of *Potamogeton* of North America
north of Mexico (continued). *E. C. Ogden* 119
- The *Senecio* on the Coastal Dunes of Texas. *V. L. Cory* 164
- Carex flexuosa* in Minnesota. *Paul C. Lemon* 167
- Scirpus Peckii* in Canada. *M. L. Fernald* 168

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NOTES ON OKLAHOMA PLANTS¹

MILTON HOPKINS AND U. T. WATERFALL

IN checking over some recent collections of Oklahoma plants we find the following species either new to Oklahoma or, for various reasons, of special interest.

The collections have been made for the most part by the junior author; the determinations have been verified by the senior author and have, in most cases, been checked by him at the Gray Herbarium.²

TYPHA TRUXILLENsis H. B. K. OKLAHOMA COUNTY: in ditch, southeast corner of packing plant, Southwest 15th and Agnew Streets, Oklahoma City, *U. T. Waterfall*, no. 3060.

This very unusual plant common to temperate and tropical South America, Central America, and the West Indies, north to southern California, Texas and Louisiana, very likely replaces *T. angustifolia* in the southwestern United States. Professor Fernald first called attention to its occurrence in Virginia³ and, puzzled by the tall forms of *Typha* which the junior author brought into the laboratory for determination, we studied all the specimens in the Bebb Herbarium, with the idea that this plant might prove to be that species. A duplicate specimen was sent to Professor Fernald and he verified our own tentative determination immediately. This represents an extension of range north from Texas. The senior author has since found it in the Arbuckle

¹ Contribution from the laboratory of the Dept. Plant Sciences, Univ. Okla., no. 78.

² The senior author is grateful to the Society of Sigma Xi whose Committee on Research Grants was kind enough to give him a grant-in-aid from its Alumni Fund for work at the Gray Herbarium during the summer of 1942.

³ RHODORA 37: 385-387. 1935.

Mountains and, although no other specimens in the Bebb Herbarium appear to be this species (of *T. angustifolia* there are only six or eight sheets in all), intensive search next spring will be undertaken in order to establish more stations for the plant if they can be found.

T. truxillensis differs from *T. angustifolia* in being much taller, the Oklahoma plants being between eight and nine feet high, and in having whitish-brown spikes and narrow, flat leaves. The leaves of *T. angustifolia* are plano-convex and its spikes are reddish-brown.

ALETRIS LUTEA Small. McCURTAIN COUNTY: sandy soil, in water oak-sweet gum association near Cypress Swamp, 7 miles southeast Broken Bow, *Waterfall*, no. 2118.

This specimen matches perfectly all the material in the Gray Herbarium but none has been seen from west of Louisiana. The only other species listed for Oklahoma is *A. aurea* and this plant is definitely not that, nor is it *A. farinosa* which reaches eastern Texas. Therefore, this collection constitutes a new record for Oklahoma and, as the station is in Oklahoma's narrow southeastern strip of Coastal Plain, it constitutes a logical extension of range to the north and west. The more we botanize in this interesting area of Cypress Swamp and pine barrens the larger number of Coastal Plain plants we find there.

ARABIS CANADENSIS IN OKLAHOMA.

During one of the numerous collecting trips to the Arbuckle Mountains, our party decided to cool off after a warm morning's work. We did so in a small dammed-up pond in the Viola Limestone formation, which we jestingly named Lacus Botanicorum. The senior author had just taken his first plunge in the crystal-clear water when the junior author spied a specimen of *Arabis* in the shade of a nearby rocky limestone ledge. When the senior author heard the good news he immediately forgot his swim and hastened to the ledge, identifying the specimen as *A. canadensis*. Though the species has been found in eastern Oklahoma it has not been seen so far west.¹

¹ RHODORA 39: 178. 1937. The specimen cited is from "Le Flore County, *T. R. Stevens* June 25, 1931 [U. S.]." This citation should read *T. R. Stemen*. The type-written label in the U. S. National Herbarium misspelled the name of the collector, and the author at the time he was writing this treatment of *Arabis*, did not know that *T. R. Stevens* should be *Stemen*, the senior author of "Oklahoma Flora" (Harlow Publishing Co., Oklahoma City, 1937).

In the spring of 1942 several plants were found in the Reagan Sandstone formation of the Arbuckles as well as in the Frank's Conglomerate. Apparently, *Arabis canadensis* is no longer a rarity in this region.

MEDICAGO MINIMA L. OKLAHOMA COUNTY: state fairgrounds in Oklahoma City, *Waterfall*, 1939-41.

Although the literature does not include this species in the Oklahoma flora, it probably was introduced with feed in the livestock exhibits at the state fairgrounds.

PHRYMA LEPTOSTACHYA L. CUSTER COUNTY: in rich woods (*Ulmus-Gymnocladus-Celtis-Juniperus*) along creek, $\frac{1}{4}$ mile south, $1\frac{1}{2}$ miles east of Weatherford, *Waterfall*, no. 2969.

The occurrence of this plant in the Wichita Mountains was reported in a previous paper.¹ This report was based on one specimen in the Bebb Herbarium, "on Little Wichita River, Comanche County, A. H. Van Vleet, July 2, 1903." Mr. Frank McMurry of the Wichita Mountains Wildlife Refuge, which is under the direction of the United States Department of the Interior, informs me that he has no record of the plant from the Wildlife Refuge, although he has botanized there more extensively than any other collector. A thorough search on all of the available maps does not indicate the existence of any stream called "Little Wichita River" and McMurry thinks that it may be a small creek of inconsequential importance, possibly a tributary of Cache (or, as it has frequently been spelled in the literature, "Cash") Creek. The junior author's present collection in Custer County is about 50 miles northwest of the mountains but by no means in the mountains themselves, and represents a northwestern extension of range for the plant in Oklahoma. The late Dr. Van Vleet (first head of the Dept. of Botany at the University of Oklahoma), unfortunately, gave very sparse information on his labels and it is not always possible to place his plants in a more specific area than the county. Inasmuch as the Wichita Mountains occupy the largest part of Comanche County it seems reasonably safe to assume that the Van Vleet specimen was actually collected there.

The two specimens in the Bebb Herbarium are the typical form of this species, not the var. *confertifolia* Fernald.²

¹ RHODORA 40: 431. 1938.

² RHODORA 37: 442. 1935.

BACCHARIS TEXANA (T. & G.) Gray. CUSTER COUNTY: 7 miles west of Clinton, *Waterfall*, no. 1629.

The junior author found a single clump of this xerophytic *Baccharis* on one of his numerous field trips in the western part of Oklahoma. He took great pains to leave a portion of this so that the station might be preserved, but on a later trip the following summer he failed to find any remaining parts of the plant.

This has previously not been recorded from Oklahoma but Cory lists it from both the Plains country and the Edwards Plateau in his *Catalogue of the Flora of Texas* (his Area No. 7).¹ Custer County is in southwestern Oklahoma very near the Texas Panhandle. Undoubtedly, it occurs spasmodically throughout that part of the state and has simply not been previously collected.

FRANSERIA TOMENTOSA A. Gray. CIMARRON COUNTY: moist spot in prairie near a thick stand of *Lippia*, 20 miles east of Boise City, *Waterfall*, no. 3136.

This is the first collection in Oklahoma and therefore constitutes another new record. In Texas Cory lists it in the Plains country (Area No. 7 in his *Catalogue*).² Boise City is in the Oklahoma Panhandle and is merely a part of the same plains country.

ACHILLEA LANULOSA Nutt. forma RUBICUNDA Farwell. OKLAHOMA COUNTY: roadside in clay soil, 2½ miles west and ½ mile north of Britton, *Waterfall*, no. 1970.

This pinkish-flowered form is found rather frequently with the typical but has not before been recorded from the state.

SOLIDAGO TRINERVATA Greene. CIMARRON COUNTY: in stony slopes of larval hills along U. S. Highway 64, 1½ miles west of Kenton, 1½ miles south of the Black Mesa near the New Mexico line, *Waterfall*, no. 3168.

This specimen, identified by Dr. S. F. Blake, represents a range extension eastward from New Mexico. The literature does not list it from Oklahoma and no specimens are extant insofar as we are able to ascertain. However, it occurs in southwestern Texas. Cimarron County is bound by Texas on the south, New Mexico on the west, and Colorado on the north. Therefore, its flora is

¹ Tex. Agri. Exp. Sta. Bull. no. 550: 102. 1937.

² Ibid.

largely that of the high plains and the existence of this species in our flora is not unusual. The Black Mesa country, consisting of large buttes of black larval rocks, has only been sparsely botanized and such interesting plants as *Pinus edulis*, *P. ponderosa* and *Juniperus monosperma* abound there. It is without question one of the most thrilling regions, botanically, in the whole state. Each of the authors has made one trip to the area, though on separate occasions, and the collections are still to be identified. Many new records for the flora are anticipated as our studies progress.

TRAGOPOGON MAJOR—A CORRECTION

The junior author reported this plant as *T. pratensis*¹, having referred his specimen to that species because of its yellow flowers. Since more material has come to our attention, a closer study has indicated that an error was made. The cited specimen has fistulose peduncles and long involucre bracts which *T. pratensis* does not have. Because of these characteristics and its yellow flowers it could not be either of the two species listed in the floras and manuals (*T. pratensis* and *T. porrifolius*). Mr. Weatherby of the Gray Herbarium very kindly identified the plant as *T. major*, "a species of central Europe recorded as an escape in various parts of the United States." Since the original collections in the state fairgrounds three years ago, several additional stations east of Oklahoma City have been found.

UNIVERSITY OF OKLAHOMA,
Norman, Oklahoma.

THE FRUIT OF *DIRCA PALUSTRIS*.—In a recent most interesting paper Dr. Rogers McVaugh² challenges the accounts in current manuals of the drupe of *Dirca palustris* as "ovoid, reddish" or "red, oval-oblong", etc., on the basis of his observation of a specimen cultivated at Kinderhook, New York, this specimen producing drupes "somewhat spindle-shaped, pale green . . . with a very slight yellowish (not reddish) tinge." He assembles an array of citations showing that most of the earlier authors did not know the fruit but that Humphrey Marshall (1785) had

¹ RHODORA 42: 501, 1940.

² McVAUGH, *The Fruit of the Eastern Leatherwood*, Castanea, vi. 83-86 (1941).

described it, presumably from southeastern Pennsylvania, as "somewhat yellowish when ripe", that Bigelow in 1818 described it as "oval, acute, red", that in 1824 Torrey said "yellowish when ripe" (the exact phrase of Marshall); while Wood (1845), Gray (1848) and Chapman all say "red" or "reddish". And although he finds in the herbaria at Washington that "In nearly all cases the dried fruits, and especially the younger ones, have a suggestion of reddish color. This color is thought to have come about as a result of the drying process and may well have been the basis for the early reports of 'red' or 'reddish' fruits for this species."

The latter proposition might seem to dispose of the matter; but rather vividly remembering the reddish or purplish drupes as known to me in Maine when a boy, I have looked up some authors who certainly knew or know *Dirca* as it occurs in the woods. McVaugh refers to the infrequent fruiting of the shrub. Nevertheless, a good proportion (36 sheets) of the material before me from Quebec, Ontario, New England, New York, Michigan, Wisconsin, Minnesota and northeastern Iowa has well-formed and fully grown or ripe fruit. Throughout this region, furthermore, botanists who knew or who know plants in the field pretty generally report the ripe fruit of *Dirca* as red. McVaugh's cultivated specimen is the only one in this northern area which I have found definitely recorded as yellowish, although Mr. Bayard Long has often urged me, in Virginia, to show him *red* fruits, since in his experience they drop, fully ripe, when green or merely tinged with yellow. Jacob Bigelow and John Torrey stand out among American botanists as accurately describing plants from field-knowledge of them. Not only in *Florula Bostoniensis*, quoted by McVaugh, but in his very detailed *Medical Botany*, Bigelow, who with his student, Dr. John Locke and others, conducted chemical and pharmaceutical studies of the plant, including experiments with "A medical student who took several of the berries [and] found that they produced nausea and giddiness" (Bigel. Med. Bot. ii. 158 (1818)), described it definitely as red. Bigelow knew it to be red; the experimenting student "saw red". Similarly, in his very detailed account in his *Flora of the State of New York*, ii. 163 (1843), Torrey, there not quoting from Marshall, said "Fruit . . . reddish when

ripe." Similarly Alphonso Wood, who lived where *Dirca* abounds, said (1845), as already quoted by McVaugh, "Drupe oval (reddish)", and L. C. Beck, Bot. ed. 2: 307 (1848) said "reddish when ripe". Going outside New England and New York we find Victorin, who has many times collected *Dirca* in fruit, saying "Fruit: un drupe rouge, ovoide oblong" (Fl. Laurent. 362); Clements, Rosendahl & Butters, describing the shrub of Minnesota in Minn. Trees and Shrubs, 209 (1912), said "drupe oval-oblong, red"; while, writing from Iowa, Pammel, Man. Poisonous Pl. 643 (1911), definitely said "drupe red, oval, oblong". It is not reasonable to believe, as one might perhaps infer from the article which induced this note, that all the field-botanists, Jacob Bigelow, John Torrey, Alphonso Wood, L. C. Beck, Asa Gray, Clements, Rosendahl, Butters, Pammel, Victorin, my student, Mr. Bernard Boivin, who, when asked the color of the fruit near Montreal, promptly responded "purplish", and myself have mistaken yellow for purple or red. It is obvious that, whereas northward the ripe fruit generally becomes reddish or purplish, southward it often or always lacks this color and may become yellowish.

Furthermore, although McVaugh describes and illustrates the mature fruit as "spindle-shaped", with prolonged base and tip, the ripe fruits in the Gray Herbarium and that of the New England Botanical Club vary from slenderly rhomboid, with tapering tips, to thick-ellipsoid, with rounded ends, or obovoid, with broadly rounded summit, or even subglobose, with summit and base strongly rounded. The shape of the fruit seems to have no special geographic localization; the color possibly may have geographic significance. Here is an opportunity for close observation by those situated to make the observations.—M. L. FERNALD.

THE BROAD-LEAVED SPECIES OF POTAMOGETON OF NORTH AMERICA NORTH OF MEXICO

E. C. OGDEN

(Continued from page 105)

5. *P. PULCHER* Tuckerman

RHIZOME buff, often with dark red spots, .5–1 mm. in diameter. **STEM** simple, terete, 1–2.5 mm. in diameter, usually con-

spicuously black-spotted; stele with the proto-type pattern; endodermis of O-cells; interlacunar and subepidermal bundles absent; pseudo-hypodermis 1 cell thick. SUBMERSED LEAVES (excluding transition leaves) of two more or less distinct types, those of the lower part of the stem semi-opaque, oblong with rounded apices; those of the upper part of the stem translucent, lanceolate to lance-linear, not arcuate, apex acutish but not sharp-pointed, both types tapering at base to short petioles (up to 1.5 cm. long) or sometimes practically sessile; blades 8-14 (-18) cm. long, 1-2.5 (-3.5) cm. wide, nerves (9-) 11-21, outer ones marginal; margins entire; lacunae 4-8 rows each side of midrib. FLOATING LEAVES coriaceous, ovate to rotund; apex rounded or bluntly mucronate; base cordate or rounded; petioles 4-18 cm. long; blades 2-7 (-11) cm. long, 1.5-4 (-8.5) cm. wide, with (19-) 21-29 (-35) nerves, all of about equal prominence, as seen by transmitted light; lacunae none or very faint. STIPULES of the submersed leaves decaying early, those of the floating leaves persistent, narrowly triangular, obtuse when young, becoming acutish with age, 2-5 cm. long, 2-keeled. PEDUNCLES of rather even thickness throughout, 5-8 (-11) cm. long. SPIKES with about 10 whorls, in fruit 2-3.5 cm. long, .8-1.1 cm. thick. FLOWERS sessile or nearly so; sepaloid connectives usually with a greenish cast, blades orbicular to elliptical, (1.2-) 1.5-2.5 (-3) mm. wide, claws, .4-.8 mm. long; anthers .8-1.4 mm. long. FRUITS obliquely ovate, rounded or cuneate at base, sides flat or slightly concave, (2.7-) 3-3.5 (-4) mm. long, (2.3-) 2.6-3.2 (-3.4) mm. wide; beak often prominent, up to .8 mm. long; keels usually prominent, acutish, the dorsal one often strongly developed, and sometimes with a basal lobe projecting below the point of attachment; exocarp mostly light brown, sometimes olive-green; endocarp with 3 prominent, acutish and somewhat muricate keels, beak linear, facial, about 1 mm. long, loop solid; apex of seed pointing .5-1.2 mm. above the basal end. Plants characterized by a conspicuously spotted stem, with large cordate floating leaves and lanceolate submersed leaves which taper rather abruptly to the base.

P. pulcher Tuckerm., Am. Journ. Sci. ser. 1: 45: 38 (1843); Morong, Mem. Torr. Club 3: no. 2: 16 (1893); Graebn. in Engler, Pflanzenr. 4: fam. 11: 67 (1907); Taylor, N. Am. Fl. 17: pt. 1: 21 (1909); Hagstr., Crit. Res. Pot. 152 (1916). *P. natans* sensu Bigel., Fl. Bost. 41 (1814), according to Tuckerm., Am. Journ. Sci. ser. 1: 45: 38 (1843). *P. lucens* var. ? *fluitans* (Roth) Gray, Man. ed. 2: 435 (1856), as to plants included in part, not *P. fluitans* Roth. ?*P. amplifolius* forma *amphibius* Benn., Journ. Bot. 42: 70 (1904). ?*P. amplifolius* var. *ovalifolius* Morong ex Benn., Journ. Bot. 42: 70 (1904); ?Graebn. in Engler, Pflanzenr. 4: fam. 11: 68 (1907). ?*P. amplifolius* var. *amphibius* (Benn.)

Graebn. in Engler, Pflanzenr. **4**: fam. 11: 68 (1907). *Spirillus pulcher* Nieuwl., Am. Mid. Nat. **3**: 16 (1913). *P. pulcher* forma *amphibius* Hagstr., Crit. Res. Pot. 153 (1916).

Shallow muddy pools, peaty pond-holes and sluggish streams chiefly of the Coastal Plain and Mississippi embayment, southern Nova Scotia, southern New Hampshire, south to Georgia, Texas, Oklahoma, Arkansas, Missouri and Minnesota. MAP 6. The following, selected from many specimens, are referred here. NOVA SCOTIA: Sears L., New Tusket, Digby Co., *Fernald & Long 23137*; Rhodeniser L., e. of Bridgewater, Lunenburg Co., *Fernald & Long 23138*. NEW HAMPSHIRE: Contoocook R., E. Jaffrey, *Rand & Robinson 1013*. MASSACHUSETTS: Foster's Pond, Andover, Essex Co., *Pease 2011*; Waushakum P., Ashland, Middlesex Co., June 1879, July 1, 1881, July 5, 1882 & Aug. 7, 1882, *Morong*; Spot P., Stoneham, July 4, 1852, *Robbins*; Whitman P., Weymouth, Norfolk Co., *Seymour 4151*; Sampson's P., Carver, Plymouth Co., *Fernald 750*; Uncatena, Elizabeth Islands, Dukes Co., *Fogg 2997*; L. Neeseponset, Dana, Worcester Co., *Goodale, Markert & Piper 96988*; Readville, Suffolk Co., June 16, 1878 & June 16, 1880, *C. E. Faxon*, also June 23, 1879, *Morong*; Natick, June 1, 1881 & Sept. 27, 1881, *Morong*; Nantucket, Nantucket Co., July 1887, *Morong*. RHODE ISLAND: ponds between Pilot Hill and Southeast Point, Block Island, Newport Co., *Fernald, Hunnewell & Long 8448*; Apponaug P., Apponaug, Aug. 26, 1880, *Morong*. CONNECTICUT: Fairfield, *E. H. Eames 8740 & 8746*; Killingworth, Middlesex Co., Aug. 19, 1915, *C. H. Bissell*. NEW YORK: River Head, Wading R., Long Island, May 25, 1878, *E. S. Miller*; Long Island, May 1890, *F. N. Tillinghast*; Valley Stream, Queens Co., Long Island, July 1886, *J. A. Bisky*; Arden, Staten Island, Oct. 9, 1886, *A. Hollick*; Rockland L., July 17, 1872, *Morong*. NEW JERSEY: Molly Wheaton Run, e. of Greenwich, Cumberland Co., *Fogg 2077*; Elmer, Salem Co., *Redfield 7996*; Cape May Court House, *Killip 30845*; Atlantic City, July 5, 1868, *C. F. Parker*. PENNSYLVANIA: Tullytown, Bucks Co., May 24, 1930, *W. M. Benner*. DELAWARE: Record's P., Laurel, Sussex Co., *Fogg 1840*; Glendaniel (Hudson) P., 2 mi. s. of Lincoln, Sussex Co., *Fogg 4504*; Indian R., Millsboro, Sussex Co., May 23, 1876, *A. Commons*; cedar swamp, New Castle Co., Sept. 20, 1867, *Commons*; Cherry Island Marsh, below Edgmoor, Wilmington, July 27, 1896, *Commons*; Canterbury, July 1874, *Wm. M. Canby*. MARYLAND: Marshyhope Creek, Federalsburg, Caroline Co., *Shreve 1622*; Blackwater R., Dorchester Co., *Shreve 1597*; Willards, Wicomico Co., Aug. 12, 1910, *J. J. Carter*. VIRGINIA: 4 miles n. w. of Waverly, Sussex Co., *Fernald & Long 5977*; brook entering Nowney Creek, Back Bay, Princess Anne Co., *Fernald, Griscom & Long 4535*; near Cornland, Norfolk Co., *Fernald & Griscom 4295*; pond near Luray Caverns, Luray,

June 1, 1909, *E. B. Bartram*; near Elko, *Grimes 4196*; vicinity of Cape Henry, *Killip 6896*; Great Dismal Swamp, *Kearney 1626*; Washington Canal, Dismal Swamp, *Boettcher 9*; Dahlia, Greenville Co., *Fernald & Long 8538*. NORTH CAROLINA: Cape Fear R., Wilmington, herb. *Hexamer & Maier 466*; Hendersonville, Henderson Co., *Biltmore Herb., 5980*^a. GEORGIA: near Huguenin, Sumter Co., *Harper 1402*; Brier Creek, Screven Co., *Harper 2088*. FLORIDA: Miccosukee L., *Sperry 509*. OHIO: Baumgartner's L., Jackson Twp., Franklin Co., Aug. 16, 1929, *H. T. Flint*. INDIANA: pond about $3\frac{1}{2}$ mi. n. w. of Grayville, Sullivan Co., *Deam 25704*; Pine Station, Lake Co., June 1884, *E. J. Hill*; Pine, Lake Co., June 21, 1897, *A. M. Chase*. KENTUCKY: Lexington, 1836, *C. W. Short*; s. e. of Mammoth Cave, Edmonson Co., *Svenson 156*. TENNESSEE: Goose P., Pelham, Grundy Co., *Svenson 9108 & 10150*. ALABAMA: Montgomery, Oct. 16, 1888, *Chas. Mohr*; slough along main highway 5 mi. w. of Tuscaloosa, Tuscaloosa Co., *Svenson 9427*. ILLINOIS: Mason Co., Aug. 1860 & Aug. 1861, *E. Hall*; Athens, Menard Co., 1861, *E. Hall*. MINNESOTA: Colby L., Taylors Falls, *Metcalf 1291*. MISSOURI: St. Louis, 1838, *N. Riehl*, also Aug. 1847, *Geo. Engelmann*; Montier, June 8, 1890, *Bush*; north of Flatwoods, Ripley Co., *Steyermark 14245*; Little Black River, Pleasant Grove, Ripley Co., *Mackenzie 359*; between Gladden & Timber, Dent Co., *Palmer & Steyermark 41417*; Hogan, Iron Co., July 15, 1898, *C. Russell*; Nettleton, Caldwell Co., May 7, 1893, *H. Eggert* (M, mixed with *P. amplifolius*; F, NY, US, not mixed). ARKANSAS: Nettleton, Craighead Co., May 7, 1893, *Eggert*; Greene Co., May 7, 1893, *Eggert*; Judsonia, June 13, 1877, *H. S. Reynolds*. LOUISIANA: Calcasieu R., St. Martinville, Oct. 7, 1893, *A. B. Langlois* (US). OKLAHOMA: Page, Leflore Co., *Blakley 1453*, also *E. J. Palmer 33310*. TEXAS: Lindale, April 23, 1901, *Reverchon* (M).

Tuckerman's original description of *P. pulcher* is brief but leaves little doubt as to what plant he referred to this species. He was certainly in error however, when he stated that it has "much larger seeds" than *P. praelongus*. He was quite familiar with the *P. praelongus* of Fresh Pond, Cambridge, where it grew abundantly and was collected there by Boott, Tuckerman, Robbins, Morong, and the Faxons. However, all of the Fresh Pond material of *P. praelongus* seen by me lacks mature fruits, and it may be that Tuckerman did not at that time realize how large the mature fruits of that species really are. His supplementary description¹ is absolutely conclusive as to the plant he was describing.

¹ Edward Tuckerman, *Am. Journ. Sci. ser. 2: 6: 224* (1848).

The forma *amphibius* and var. *ovalifolius* which Bennett referred to *P. amplifolius* may possibly be *P. pulcher*. They have been discussed under *P. amplifolius*. Hagström's forma *amphibius* is the terrestrial state so common to *P. pulcher*.

6. *P. NODOSUS* Poiret

RHIZOME white, suffused or spotted with rusty red. **STEM** simple, terete, often pressing very flat, 1–1.5 (–2) mm. in diameter; stele with the trio-type pattern, with the phloem on the inner face of the trio-bundle appearing as one patch; endodermis of O-cells (rarely more thickened on the inner face and appearing as U-cells); interlacunar and subepidermal bundles absent; pseudo-hypodermis absent. **SUBMERSED LEAVES** thin, linear-lanceolate to broadly lance-elliptical, 9–20 cm. long, 1–3.5 cm. wide, tapering gradually at base into a petiole 2–13 cm. long, tapering gradually to an acutish (but not sharp pointed) apex; nerves 7–15; lacunae of 2–5 rows along the midrib; margin of young blades with fugacious translucent denticles. **FLOATING LEAVES** coriaceous, with long petioles; blades lenticular to elliptical, cuneate or somewhat rounded at base, apex acutish to rounded (sometimes with an obtuse mucro), (3–) 5–9 (–11) cm. long, (1.5–) 2–4 (–4.5) cm. wide; nerves (9–) 13–21; lacunae rarely present. **STIPULES** of submersed leaves brownish, often delicate and decaying early, linear, acute or obtuse, 3–6 (–9) cm. long; those of the floating leaves similar but usually broader at base and more or less 2-keeled. **PEDUNCLES** usually thicker than the stem, 1.5–2.3 mm. in diameter, 3–15 cm. long. Young **SPIKES** compact but becoming loose at anthesis, of 10–15 (–17) whorls of flowers; at maturity usually not densely fruited, 3–6 (–7) cm. long, .8–1 cm. thick. **FLOWERS** sessile; sepaloid connectives greenish or brownish, orbicular or elliptical, (1.4–) 1.6–2.2 (to 2.6 on basal flowers) wide; anthers 1–1.4 mm. long. **FRUITS** obovate, 3.5–4 (–4.3) mm. long, 2.5–3 mm. wide; keels prominent, the dorsal strongly developed, especially upward, the laterals often muricate; beak facial, short; exocarp of mature fruits brownish or reddish; endocarp with keels strongly developed, dorsal often .5 mm. wide, the laterals strongly muricate, beak linear, erect, up to 1 mm. long, loop solid; apex of seed pointing a little above the basal end.—A variable species characterized by floating leaves cuneate at base, narrowly lanceolate submersed leaves tapering gradually to each end, and reddish fruits with strongly developed, often muricate, keels.

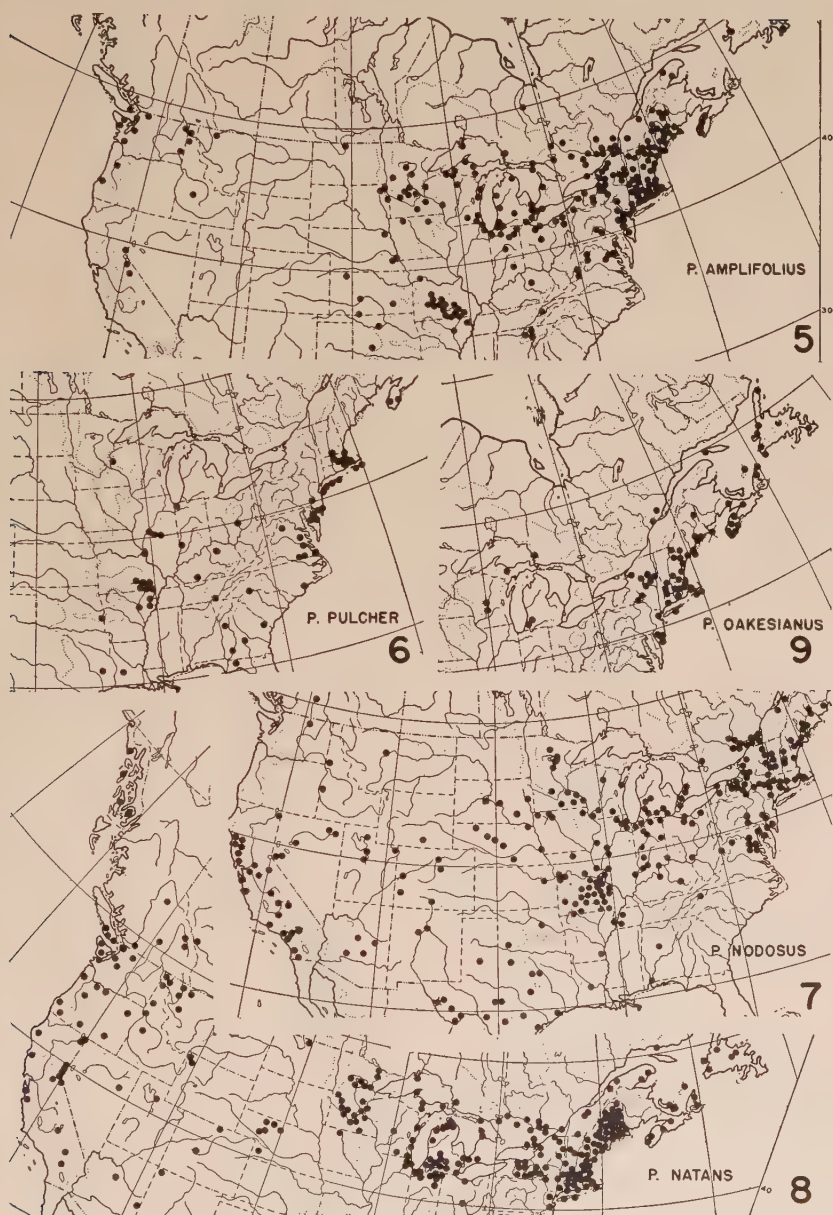
P. nodosus Poiret in Lamarck, Enc. Meth. Bot., Suppl. **4**: 535 (1816); Hagstr. Crit. Res. Pot. 183 (1916). *P. americanus* C. & S., Linnaea **2**: 226 (1827); Benn., Journ. Bot. **31**: 297 (1893); Taylor, N. Am. Fl. **17**: pt. 1: 19 (1909). *P. occidentalis* Sieber

ex C. & S., *Linnaea* **2**: 224 (1827); Taylor, N. Am. Fl. **17**: pt. 1: 20 (1909). ?*P. montanus* Presl, Rel. Haenk. **2**: 85 (1835). *P. natans* var. *fluitans* sensu Torr. Fl. N. Y. **2**: 244 (1843). *P. lonchites* sensu Tuckerm., Am. Journ. Sci. ser. 2: **7**: 350 (1849), and subsequent Am. authors, not Tuckerm., *ibid.* ser. 2: **6**: 226 (1848). *P. lucens* var. ? *fluitans* (Roth) Gray, Man. ed. 2: 435 (1856), in part. ?*P. plantagineus* var. *jamaicensis* Grisebach, Fl. Brit. W. Ind. 506 (1861). ?*P. mexicanus* Benn., Journ. Bot. **25**: 289 (1887); ? Morong, Mem. Torr. Club **3**: no. 2: 22 (1893); ? Raunk., Bot. Tidskr. **25**: 266 (1903); ? Graebn. in Engler, Pflanzenr. **4**: fam. 11: 57 (1907); ? Taylor, N. Am. Fl. **17**: pt. 1: 18 (1909). *P. lonchites* var. *novaeboracensis* Morong, Mem. Torr. Club **3**: no. 2: 20 (1893). *P. americanus* var. *novaeboracensis* (Morong) Benn., Journ. Bot. **31**: 297 (1893). *P. pennsylvanicus* var. *portoricensis* Graebn. in Urban, Symb. Antill. **4**: 73 (1903), at least in part. *P. Nuttallii* var. *portoricensis* Graebn. in Engler, Pflanzenr. **4**: fam. 11: 56 (1907), at least in part. *P. fluitans* subsp. *americanus* (C. & S.) Graebn. in Engler, Pflanzenr. **4**: fam. 11: 60 (1907). *P. fluitans* subsp. *americanus* proles *novaeboracensis* (Morong) Graebn. in Engler, Pflanzenr. **4**: fam. 11: 62 (1907). ?*P. coloratus* var. *jamaicensis* (Griseb.) Graebn. in Engler, Pflanzenr. **4**: fam. 11: 69 (1907). ?*P. insulanus* Hagstr., Crit. Res. Pot. 154 (1916). *P. rotundatus* Hagstr., Crit. Res. Pot. 153 (1916). *P. fluitans* sensu Am. authors, ? not Roth, Tent. Fl. Germ. **1**: 72 (1788). *Spirillus lonchites* (Tuckerm.) Nieuwl., Am. Mid. Nat. **3**: 16 (1913).

A widespread species of ponds and streams, generally in flowing water, southern Quebec and New Brunswick to southern British Columbia, south to Virginia, Tennessee, Louisiana, and California. MAP 7. Mexico and the West Indies, South America (rare), Eurasia, Africa. The following, selected from a large series, are representative: QUEBEC: St. Lawrence River, St. Jean-Port-Joli, L'Islet Co., *Svenson & Fassett* 934; Saint-Lambert de Lauzon, Levis Co., *Victorin, Rolland & Meilleur* 43858; Sainte-Rose, Laval Co., *Victorin & Rolland* 43565 & 49304, also *St. Cyr* 3030; Longueuil, Chambly Co., *Rolland* 43359; Angers, Ottawa R., *Rolland* 19269; Wakefield, *John Macoun* 62015 & 62016; Sainte-Sulpice, L'Assomption Co., *Ricard & Boivin* 342. NEW BRUNSWICK: St. John R., Lincoln, Sunbury Co., *Fassett* 2149. MAINE: Houlton, Aroostook Co., Aug. 26, 1897, *Fernald*; Pushaw Stream, Old Town, Penobscot Co., *Ogden, Steinmetz & Prince* 1596, also *Steinmetz* 326. Androscoggin R., Gilead, Oxford Co., Oct. 1, 1897, *Furbish*; Sydney, Kennebec Co., *Fernald & Long* 12389; St. George R. near Indian Garden, Warren, Knox Co., Aug. 15, 1913, *Norton*. NEW HAMPSHIRE: Connecticut R., vicinity of Hanover, Grafton Co., Aug. 17, 1876, *H. G. Jesup*; Cornish, Sept. 2, 1886, *F. H. Knowlton*. VERMONT: Ferrisburg

and Vergennes, many collectors; Lake Champlain, Orwell, Addison Co., *Cushman* 6007; Hydeville, Rutland Co., July 21, 1892, *Eggleston*; Winooski R., Burlington, Aug. 25 & 27, 1885, *Morong*. MASSACHUSETTS: Concord, Aug. 12, 1887, *E. S. Hoar*; Mystic P., Oct. 1, 1865, herb. *Wm. Boott*; Winchester, Sept. 1, 1880, Aug. 8 and Aug. 29, 1881, *Morong* (the latter mixed with *P. nodosus* × *epihydus* in Gray Herb.); Connecticut R., Springfield, Sept. 6, 1864, *Robbins*; Harmon P., Sheffield, Berkshire Co., Aug. 12, 1914, *R. Hoffmann*; Pauls Bridge, Neponset R., Readville, May 30, 1881, herb. *E. & C. E. Faxon*; Egremont, *Standley & Killip* 7649. CONNECTICUT: New Hartford, *Driggs* 40; Twin Lakes Station, Salisbury, Litchfield Co., Aug. 20, 1935, *Fernald & Ogden*; Lake Whitney, New Haven, Sept. 24, 1886, *W. A. Setchell*; Housatonic R., Stratford, 1845, *Robbins*; Housatonic R., Newtown, Fairfield Co., *A. E. Blewitt* 3657. NEW YORK: N. Beaver Creek, Haynes Hill, W. Fort Ann, Washington Co., Aug. 26, 1914, *Burnham*; Guildenland, Albany Co., *House* 21774 & 22044; Ellisburg, Jefferson Co., *House* 19852 & 20002; Ithaca, Tompkins Co., *R. Hitchcock* 11167 & 11168; Lake Erie, Buffalo, Aug. 20 & 25, 1886, *Morong*; Niagara Rapids, *E. Tuckerman* (*P. lonchites* of Tuckerman's supplementary description, but not of original description); pool near White Creek, DeKalb Co., *Phelps* 1091; Grass R., Canton, *Phelps* 1665; Raquette R., above Potsdam, St. Lawrence Co., *Muenschler & Clausen* 3751 & 3752; Float Bridge, Rochester, *Baxter* 5389; Chemung R., Chemung Co., *Lucy* 424 & 10816. NEW JERSEY: Oldmans Creek, 1.5 mi. n. n. e. of Eldridges Hill, Salem Co., *Fogg* 6794. PENNSYLVANIA: Harrisburg, Sept. 1893, *John K. Small*; Penn's Creek at the "Swinging Bridge," Selinsgrove, Snyder Co., *Moldenke* 4208; Sellersville, 1868, *C. D. Fretz*; vicinity of McCalls Ferry, York Co., *Rose & Painter* 8205; Chester Co., July 1858–1864, *S. P. Sharples* 303. DELAWARE: Shelpot Creek, Wilmington, June 17, 1879, *A. Commons*; Brandywine, Wilmington, Aug. 17, 1896, *A. Commons*; White Clay Creek, Stanton, Sept. 4, 1896, *A. Commons*. MARYLAND: Chicomuxen Creek, *Tidestrom* 7637; Mill Creek, Chesapeake Bay region, *Shull* 95; Cabin John, Montgomery Co., *Painter* 1189, also *Dowell & Painter* 5385; Chesapeake Canal above Cabin John, near Lock 13, *Leonard & Killip* 603; Spesutie Island, Harford Co., *Moldenke* 9396; Great Falls, *House* 517. DISTRICT OF COLUMBIA: Arlington Junction, Sept. 28, 1897, *E. S. Steele*; C. & O. Canal above Georgetown, Aug. 9, 1897, *T. H. Kearney*; Georgetown, *Van Eseltine & Moseley* 202; Fish Ponds, *Shull* 39. WEST VIRGINIA: Cacapon R., Hardy Co., Aug. 13, 1930, *W. V. U. Bot. Exped.*; Tygart R., Beverly, Randolph Co., *Millspaugh* 457. VIRGINIA: Four-Mile Run, Chesapeake Bay region, *Shull* 474; near Leedstown, *Tidestrom* 7741; Potomac R., The Dyke, *Tidestrom* 7183; Dyke,

Fairfax Co., *Metcalf & Sperry* 1622 & 1630 Hunting Creek, *McAtee* 2374. ONTARIO: Rideau R., at Billings Bridge, Ottawa, *Malte* 118274; Mississippi R., Galetta, Carleton Co., *Ogden & Bolan* 1629 & 1630; Chatham, *Cain* 935; Nation R., Casselman, Aug. 21, 1884, *John Macoun*, also *Malte* 118275; Nation R., Russel, *Macoun* 22177; Maitland R., Goderich, *Macoun* 26839; Golden L., Renfrew Co., *Macoun* 22177, Dunnville, *John Macoun* 26841; near Lake Muskoka, Aug. 29, 1899, *D. LeRoy Topping*; L'Original, *Rouleau* 304. MICHIGAN: Kalamazoo R., Allegan Co., *Wight* 86, 87a, 87b, 87c, 88, 98 & 123; Grand Rapids, July 21, 1895, *W. E. Mulliken*; Vandercooks L., Jackson Co., July 21, 1898, ex herb. *S. H. & D. R. Camp*; Pine L., Aug. 20, 1892, *C. F. Wheeler*; Gun R., Barry Co., July 1926, *Oosting*; Freemont L., Newaygo Co., July 9, 1926, *Oosting*; Black L., Ottawa Co., Aug. 27, 1926, *Oosting*; Huron R., 3½ mi. s. e. of Ann Arbor, Washtenaw Co., *Hermann* 9383. OHIO: Brady L., Portage Co., July 29, 1913, *R. J. Webb*; Put-in-Bay, Aug. 1898, *A. J. Pieters*; Presque Isle Point, Sandusky Bay, Aug. 19 & 29, 1895, *E. L. Moseley*; Buckeye Creek, Liberty Twp., Jackson Co., *Pontius & Bartley* 18. INDIANA: Walnut Creek, 2 mi. n. e. of Bainbridge, Putnam Co., *E. J. Grimes* 594; Aberdeen, Ohio Co., *Deam* 56783; Lake Maxinkuckee, *Scovell* 32; Tippecanoe R., 6 mi. n. and 1 mi. e. of Winamac, Pulaski Co., *Welch* 2106; Calumet R., Clarke, *Lansing* 1059; n. of Spencer, Owen Co., *Deam* 38978; mouth of John's Creek, Wells Co., July 2, 1905, *Deam*. KENTUCKY: 3 mi. s. of Richmond, Madison Co., *Svenson* 7216; Kentucky R., June-July, *Dr. Short*; Ohio R., Louisville, Sept. 16, 1854, *C. Mohr*. TENNESSEE: n. fork of Holston R., near Kingsport, Hawkins Co., *Sharp & Underwood* 33521; Reelfoot L., Lake Co., *Demaree* 7051 & 7132. ALABAMA: Mobile R. near Piute Island, May 28 & July, 1884, *Chas. Mohr*; East L., near Birmingham, Jefferson Co., *Biltmore Herb.* 5806^b. WISCONSIN: between Duck Creek R. and Bars Channel, Green Bay, July 28, 1891, *Schuetz*; Wisconsin R., near Newport, Delton, Sauk Co., Aug. 26, 1906, *A. B. Stout*; Pickerel Slough, Prairie du Chien, Crawford Co., *Fassett* 4350; Lake Mendota, Middleton, Dane Co., *Fassett* 3148; near Tomahawk, *Cheney* 1086. ILLINOIS: Calumet L., Chicago, *Chase* 1420; Wolf L., Chicago, June 10, 1911, *Sherff*; Du Page R., Naperville, June 22, 1895, *L. M. Umbach*; Ogden Ditch, Summit, *Hill* 159, 1909; Lyons Twp., Cook Co., *Hill* 151, 1901; Fox R., Richland Co., *Ridgway* 3318; Lake Lawrence, Lawrence, *Ridgway & Eaton* 3425; Swan L., near Grafton, Calhoun Co., *Metcalf* 1105; Oquawka, 1879, *H. N. Patterson*. MINNESOTA: Wabana L., Itasca Co., *Metcalf* 1471, also *Kubichek* 148 & 149; Borden L., Garrison Twp., Crow Wing Co., *Hotchkiss & Jones* 480 & 4109; Ft. Snelling, June 1895, *E. P. Sheldon*, also *Mearns* 805; Minn. R. bottoms, Dakota



RANGES OF POTAMOGETON

Co., June 1895, *E. P. Sheldon*; Green L., Kandiyohi Co., *Metcalf* 2046; Mazaska L., Rice Co., *Keck & Stilwell* 401; Courtland, Nicollet Co., July 1892, *C. A. Ballard*. IOWA: Fayette, July 1893, *B. Fink*; Estherville, Aug. 7, 1897, *R. I. Cratty*; Granite, Lyon Co., Aug. 4, 1896, *B. Shimek*; Des Moines R., July 1881, *R. I. Cratty*. MISSOURI: along Current R., near Doniphan, Ripley Co., *Steiermark* 9233, 14257 & 14259; Gasconade R., s. e. of Hazel Green, Pulaski Co., *Steiermark* 25102 & 25103; n. w. of Waynesville, Pulaski Co., *Steiermark* 25249; Gasconade R., n. e. of Vienna, Maries Co., *Steiermark* 25603; Buffalo Creek, s. e. of Louisiana, Pike Co., *Steiermark* 25876; Sect. 6, w. of Lynchburg, Laclède Co., *Steiermark* 27148; Osage R., Mary's Home, Miller Co., *Steiermark* 13083 & 13097; Iron Mountain L., *Metcalf* 842; Killarney L., East Arcadia, *Metcalf* 845; Ice P., Unionville, *Metcalf* 1071; Duck L., Platte Co., *Metcalf* 1024; Goose P., Springfield, *Standley* 9780; Gascondy, *Emig* 224; e. of Ashland, Boone Co., *Drouet* 3028; n. w. of Joplin, Jasper Co., *Palmer* 21526; Meramec, Sept. 2, 1886, *Eggert*; Meramec R., St. Louis Co., Sept. 12, 1886, *Eggert*; Atherton, Jackson Co., *Bush* 630; Sheffield, Jackson Co., Aug. 4, 1896, *Mackenzie*; White R., Forsythe, Taney Co., *Trelease* 817. ARKANSAS: Big L., Hornersville, *Metcalf* 636; Saline R., Ozment Bluff, Drew Co., *Demaree* 17893. SOUTH DAKOTA: Sioux R., near Brookings, Sept. 1, 1893, *T. A. Williams*; Medicine Creek, near Canning, Aug. 16, 1892, *T. A. Williams* 1; s. of St. Pierre, Stanley Co., *Over* 17432. NEBRASKA: Niobrara R., southwest of Valentine, *Tolstead* 637; Middle Loup R., near Norway, Thomas Co., *Rydberg* 1421; Anselmo, July 6, 1889, *Weber* 6; Lake Manawa, near Omaha, *Lawton* 50. KANSAS: Topeka, Aug. 1870, *E. Hall*. OKLAHOMA: near Cache, Comanche Co., *Stevens* 1364 (G, US, mixed with *P. amplifolius*, NY, not mixed); Sapulpa, *Bush* 1207. TEXAS: Comanche Spring, New Braunfels, *Lindheimer* 1234; Little Aguja Canyon, Jeff Davis Co., *Moore & Steiermark* 3077; Haley Ranch, Brewster, *Cory* 9198; Victoria, *Lindheimer* 393; Lake Polk, near Temple, Bell Co., *Wolff* 3290; Dallas, June 25, 1929, *Mary R. Stephenson*; Lubbock, *Reed* 3168; Nueces R., Uvalde, Uvalde Co., *Palmer* 33707; Houston, Harris Co., *Palmer* 11952; Sycamore Creek, Fort Worth, *Ruth* 141. MONTANA: Great Falls, *R. S. Williams* 285. IDAHO: Payette, *Henderson* 4882. WYOMING: Ft. Steele, Carbon Co., *Goodding* 539. COLORADO: Lee's L., *Crandall* 2530; Alamosa, *Clements* 305; Rio Grande, Alamosa, *Shear* 3745; Owen's L., Boulder, *Daniels* 683; Gunnison R., Grand Junction, Mesa Co., *Biltmore Herb.* 5806^a. UTAH: Hills Park, Salt Lake City, June 29, 1908, *Mrs. J. Clemens*; Hill Creek, Uinta Basin, Uinta Co., *Graham* 9821; near Goshen's fixed sand-dunes, Utah Co., *Garrett* 3958; Corinne, *Wetmore* 395. NEVADA: Hot Creek, near Gold Creek, Elko Co., *P. B. Kennedy*

4476; Glendale, Truckee valley, Washoe Co., *P. B. Kennedy* 3041; Sparks, near Reno, *A. E. Hitchcock* 444; North Fork, *A. E. Hitchcock* 1034; Wadsworth, *Tidestrom* 10655. NEW MEXICO: Santa Fe, *Fendler* 837; San Jose, near Santa Fe, *Arsène & Benedict* 16636; Albuquerque, Oct. 13, 1894, *C. L. Herrick*. ARIZONA: Camp Verde, *W. W. Jones* 432; Lower Oak Creek, *Fulton* 9703; Granite Reef Dam, Maricopa Co., *Peebles* 14190; Pinal Creek, *Toumey* 496; Beaver Creek, *MacDougal* 543. CALIFORNIA: Pit R., at Lookout, Modoc Co., Aug. 24, 1899, *M. S. Baker*; Big R., Mendocino Co., *McMurphy* 192; Russian R., n. of Cloverdale, Mendocino Co., *Heller* 5824; Mormon Creek, Tuolumne Co., *Williamson* 309; Santa Cruz, *M. E. Jones* 2310; Visalia, Tulare Co., *Coville & Funston* 1278; Bakersfield, Kern Co., *Coville & Funston* 1244; Laguna Lakes, Orange Co., *Street & Williams*, 2689; Colton, San Bernardino Co., *Parish* 2106 & 2128; Deep Creek, San Bernardino Mts., San Bernardino Co., *L. C. Wheeler* 1974. WASHINGTON: Okanogan R., *Sereno Watson* 398. BRITISH COLUMBIA: Kamloops, June 26, 1889, *John Macoun* 2970.

P. fluitans of European authors consists of two quite independent plants: one a fruiting plant with an endodermis of O-cells and no bundles in the cortex; this occurs in North America. The other is a sterile plant with an endodermis of U-cells and with numerous bundles in the cortex; this plant is thought to be a hybrid, *P. lucens* × *P. natans*. Roth's original description,

P. foliis inferioribus longissimis, lanceolatis, acuminatis, membranaceis; superioribus ovali-lanceolatis, coriaceis: omnibus petiolatis.

Habitat in fossis profundis lente fluentibus et in Hunte fluuio Ducatus Oldenburgensis,

would include both plants. The fact that no fruits are described does not at all mean that Roth's plant lacked them, for at that time vegetative characters were given prominence and the fruits often ignored. Of the thirteen species of *Potamogeton* described in Roth's flora where *fluitans* is proposed as new, not one of them has any mention of fruit. Even if Roth's specimens lacked fruit, it does not follow that they were the non-fruiting entity with bundles in the cortex. Bennett thought the name *fluitans* ought to be kept for the hybrid, saying, "We have no certain knowledge of any specimen of Roth's species being preserved in any herbarium; but there are at Munich specimens in Schreber's herbarium, named as such and gathered 'In Seebach, 1775,' and others, 'In Seebach, 1782.'" It seems to me a reason-

able inference that these specimens are from (or seen by) Roth; the more so because there are other species in the same collection actually received from Roth, and signed by him. They are the plant we call *fluitans* in England (hybrid?)¹. Later he adds, "The following extract from Roth's *Catalecta Botanica* (fasc. 1, p. 31, 1797) will show that Schreber's specimens in the Munich Herbarium are, as I supposed, the plant of Roth: . . . 'Prope *Erlangam* etiam observavit Ill. Praes. *de Schreber*'"². To this Raunkiaer answers, "that because a herbarium contains plants actually from Roth it can not be necessary that other plants in the same herbarium should be from him. The specimens from the Munich herbarium mentioned have been examined by me and that they belong to the barren form of *P. fluitans* is true enough but they can not in the least be considered original specimens."³ He then attempts to show that in the Bremen herbarium there is a specimen which has a good chance of being the original; and it is the plant with O-endodermis and lacking bundles in the cortex. He also states that in the "Petersburg herbarium and examined by me . . . three specimens . . . may well be original specimens."⁴ As these specimens also proved to be the fertile plant he concludes that we should retain the name *P. fluitans* for the fertile species which lacks strengthening tissue in the cortex. Hagström agrees that "This proof would be very strong, if those specimens examined also really corresponded with the original description by Roth 'foliis inferioribus longissimis' . . . which they can scarcely be said to do."⁵ From Roth's later and more detailed description⁶ it does appear that he then was at least including the barren form with his *P. fluitans*. Also, it would seem, if Roth had in mind the specimens in the Bremen and Petersburg herbaria when drawing up his original description, that he would have mentioned them in his *Catalecta Botanica*, as he does mention the Schreber specimens. It thus appears that the evidence that *P. fluitans* should be retained for the fruiting plant is not strong, and I am

¹ Arthur Bennett, *Journ. Bot.* 31: 296 (1893).

² ———, *Journ. Bot.* 39: 198 (1901).

³ C. Raunkiaer, *Bot. Tidskr.* 25: 278 (1903).

⁴ ———, *Bot. Tidskr.* 25: 278 (1903).

⁵ J. O. Hagström, *Crit. Res. Pot.* 184 (1916).

⁶ A. G. Roth, *Tent. Fl. Germ.* 2: 202 (1789).

inclined to agree with Hagström in treating it as a *nomen confusum*. Hagström takes up for this plant *P. nodosus* Poiret.

P. nodosus Poiret is based on a plant from the Canary Islands, collected by Broussonet. This specimen should be in the Paris Museum. A photograph of it was, some years ago, requested by the Gray Herbarium but not received. The original description agrees with the specimens here placed under that name, but is not conclusive. Until it can be shown that the Canary Island plant is not the wide-ranging species correlated with it, it is best to retain Poiret's name, as taken up by Hagström, for the American plant.

The species in North America is a rather variable one. The floating leaves especially vary greatly in size. Morong's var. *novaeboracensis* (of *P. lonchites*) covers the large-leaved form, which in America is less frequent than the narrow-leaved form. In Europe the broad-leaved plants are the more common. Which form is represented by the Broussonet specimen I am at present unable to say, but at any rate this size-variation appears not to be worth nomenclatorial distinction. The robustness of the plant does not correlate with other variations and the intermediate forms are the most common. Even the fruits of this species show a diversity in the prominence of the keels, but this, too, does not correlate with other differences, and sometimes a marked variation is found on an individual plant. When typically developed, the keels are strongly prominent; their lack of development is probably mostly due to a rapid maturation—a ripening before the endocarp is fully formed. Unkeeled fruits invariably have aborted embryos.

From Missouri westward, this species tends to have smaller floating leaves of a more yellowish green than those typical of the east. Correlated with this is a smaller fruit with less strongly developed keels (*P. rotundatus* Hagstr.). However, the typical large green leaf is also common in the west, as well as all degrees of intermediate forms. Also, some specimens with small yellowish leaves may exhibit fruits as strongly keeled as those of the typical eastern plants.

In 1848, Tuckerman described as *P. lonchites* a plant with
 "stem . . . much branched, . . . Submersed leaves
 . . . with 6-8 prominent nerves," (making no mention of a

petiole) and "floating leaves delicate, . . . always more or less tapering above and waved above, . . . stipules . . . shortish . . . Nutlets small . . . obscurely tricarinate." He stated that it was "near to *P. heterophyllus* of authors, (*P. gramineus*, Fr., Koch.)."¹ The following year he remarked further on his *P. lonchites* and spoke of "a remarkable state of this species . . . In this the stem is simple . . . and the . . . leaves are either all coriaceous and floating, or only the lowest submembranaceous, . . . the whole habit of which accords, often strikingly with that of *P. fluitans*; but its strongly marked fruit at once refers it to the present species. The published description of the fruit of this species was from immature nutlets. The following is taken from perfectly ripe ones . . . The lateral keels are conspicuous when dry . . . The exocarp being removed, the back appears acutely carinate, and a little alate, especially above."² It is quite evident from a comparison of the two descriptions and an examination of specimens labeled "*P. lonchites*" by Tuckerman that he was dealing with two separate and distinct species. Plants in the Gray Herbarium which, though not fruiting, otherwise fit his original description perfectly and are labelled "*Potamog. lonchites*" in Tuckerman's hand, have no close relationship to the plants associated with that name by Robbins, Morong and, following them, some other American authors, but are flowing-water forms of *P. gramineus* var. *maximus*. Tuckerman's supplementary description was based on *P. nodosus*, which he mistook to be a state of his *P. lonchites*, as a specimen in the Gray Herbarium clearly shows.

P. rotundatus was based by Hagström on four specimens: one each from Nebraska, California, New Mexico and Mexico. Although referring it to the subsection *Amplifolii*, he states: "I have scarcely met with a species corresponding so nearly to *P. nodosus* as regards the stem-anatomy as this. It differs by the smooth leaf margin, the long lower petioles, the prasinous leaf-colour, the ligules, the styles, and chiefly by the characteristic fruits."³ In the Gray Herbarium are specimens from three of the collections cited. All lack true submersed leaves. The

¹ Edward Tuckerman, Am. Journ. Sci. ser. 2: 6: 226 (1848).

² Edward Tuckerman, Am. Journ. Sci. ser. 2: 7: 351 (1849).

³ J. O. Hagström, Crit. Res. Pot. 154 (1916).

Nebraska plant (*Rydberg*, no. 1421) has no fruit; the specimen from New Mexico (*Fendler*, year 1847) has fruit which is definitely keeled. The Mexican collection (*Pringle*, no. 1390) alone has the fruits as described by *Hagström*. That they lack keels is true enough, but that they are quite immature is also evident. Numerous specimens of *P. nodosus* show immature spikes the fruits of which vary greatly in the development of keels. As to the leaf-margin, the denticles on the submersed leaves of *P. nodosus* are so extremely fugacious that they are seldom found in any but the youngest leaves. Young leaves of plants approaching the appearance of *P. rotundatus* have denticles as freely as those of typical *P. nodosus*. The stipules ("ligules") of typical *P. nodosus* are often scarcely if at all keeled, so that the lack of keels on those of *P. rotundatus* is not sufficient for its separation.

The species proposed by *Hagström* as *P. insulanus* is based on a single specimen from Puerto Rico: *Sintensis*, no. 2537, in the herbarium at Stockholm. Originally identified as *P. pensylvanicus* Willd. (*P. epihydrus* Raf.) by *Bennett*, this collection (at least the specimen in the Berlin herbarium) became, with *Sintensis*, no. 1025, the type material upon which *P. Nuttallii* var. *portoricensis* *Graebner* was based. *Hagström* refers *Sintensis*, no. 1025 to *P. nodosus*, though saying, "dubious . . . probably . . . what I call *P. insulanus*." The two numbers before me show clearly that neither has any affinity to *P. epihydrus* (*P. pensylvanicus* or *P. Nuttallii*), as has already been pointed out by *Fernald*.¹ The number 1025 is rather definitely *P. nodosus*. The number 2537 in the Gray Herbarium is sterile and with small abnormally developed submersed leaves. It appears to be either an ecological form of *P. nodosus* or possibly a hybrid between *P. nodosus* and some member of the subsection *Lucentes*.

Just what *P. mexicanus* *Ar. Benn.* is cannot be definitely determined. *Bennett's* description agrees rather well with *P. nodosus*, except: "Fruit 3/16 in. long by 1/4 in. broad." However, fruits seen by *Morong* were described by him as being "2 lines long, 1½ lines wide,"² less than half as wide, so it can be concluded that *Bennett's* "1/4 in." is in error. *Graebner*, who evidently found it convenient to compute his measurements from

¹ M. L. Fernald, *Mem. Am. Acad. Arts & Sci.* 17: pt. 1: 119 (1932).

² Thomas Morong, *Mem. Torr. Club* 3: no. 2: 23 (1893).

Bennett's description, gives "5 mm longi et 6 mm lati."¹ Specimens in the Gray Herbarium and cited by Graebner are sterile, but referable to *P. nodosus*.

P. occidentalis, described by Chamisso and Schlechtendal and credited to Sieber, appears, from the description and excellent illustration of the fruit, to be typical *P. nodosus*.

Just what *P. plantagineus* var. *jamaicensis* Grisebach represents is not determined. From the description and judging from the plants found in Jamaica, it appears to be *P. nodosus*. Further study is needed on the subsection *Nodosi* of Central America and the West Indies.

7. *P. NATANS* Linnaeus

RHIZOMES white with reddish spots when fresh, buff with dark red spots when dry (these spots often with lighter centers). **STEM** simple or rarely branched, terete, .8–2 mm. in diameter, with transverse ridges (these also on the rhizome and submersed leaves); stele with the trio-type pattern, the phloem on the inner face of the trio bundle appearing as 2 distinct patches; endodermis well developed, of U-cells; interlacunar and subepidermal bundles present; pseudo-hypodermis 1 cell thick. **SUBMERSED LEAVES** coriaceous, semi-terete, narrowly linear (excluding transition leaves), no differentiation between blade and petiole, tapering at the apex to an obtuse tip, 10–20 cm. long, .8–2 mm. wide; nerves 3–5, obscure. **FLOATING LEAVES** coriaceous, with long petioles 1–2.5 mm. thick, each having a brownish curved joint-like portion at its junction with the blade; blades ovate to oblong-ovate (sometimes ovate-elliptic), cordate to rounded or rarely tapering at base, apex rounded or with an obtuse mucro, 4–9 (–12) cm. long, 2.5–6 (–6.5) cm. wide; nerves (13–) 23–37, with about one-third of them prominent; lacunae none or obscure. **STIPULES** of submersed leaves clasping the stem, whitish, fibrous, persistent, linear to lanceolate, cucullate at apex in the bud, splitting on maturity and becoming raggedly obtuse, or twisting and becoming acutish, 4.5–9 (–11) cm. long, about 5 mm. wide at base, with 2 well-developed keels and many fine nerves; those of the floating leaves similar but usually broader (up to 12 mm. wide at base). **PEDUNCLES** as thick as or slightly thicker than the stem, 3–8 cm. long. **SPIKES** in anthesis compact, with 8–14 whorls; in fruit 3–5 cm. long, .9–1.2 cm. thick. **FLOWERS** sessile or nearly so; sepaloid connectives greenish, reniform to orbicular, (1.6–) 1.8–2.2 (–2.8) mm. wide; anthers about 1 mm. long. **FRUITS** obovoid, (3–) 3.5–5 mm. long, 2.5–3.5 mm. wide; keels none or rounded or with dorsal keel some-

¹ P. Graebner, in Engler, Pflanzenr. 4: fam. 11: 57 (1907).

what prominent if dried before fully mature; beak short and broad; exocarp sack-like, wrinkled, bright orange drying to buff (greenish when immature); endocarp more or less pitted on each side, and with 2 longitudinal sinuses on the back forming 3 rounded keels, beak linear, about 1 mm. long, loop solid; apex of seed pointing toward the basal end. Plants mostly with strongly developed cordate floating leaves and with the narrowly linear submersed leaves decaying early.

P. natans L., Sp. Pl. **1**: 126 (1753); Morong, Bull. Torr. Club, **13**: 145 (1886), Mem. Torr. Club **3**: no. 2: 13 (1893); Graebn. in Engler, Pflanzenr. **4**: fam. 11: 42 (1907); Taylor, N. Am. Fl. **17**: pt. 1: 16 (1909); Hagstr., Crit. Res. Pot. 191 (1916). *P. natans* var. *prolixus*, sensu Am. authors; an Koch?

A common species of lakes and streams, Newfoundland, south to Pennsylvania, west to California, and north to southern Alaska. MAP 8. EURASIA. The following, selected from a large series of specimens are representative: NEWFOUNDLAND: Bishop Falls, Valley of Exploits R., *Fernald, Wiegand & Darlington* 4461; Highlands P., Crabbes, *Kennedy* 80; 4 miles northeast of Port à Port, *Mackenzie & Griscom* 10043. QUEBEC: Mingan Islands, Saguenay Co., *St. John* 90081; Maria, Bonaventure Co., *Victorin, Rolland & Jacques* 33316; marly pond, Grand R., Gaspé Co., *Collins, Fernald & Pease* 5295; Lac Porc-Épic, Saint-Fabien, *Rousseau* 30003; Black L., Megantic Co., *Fernald & Jackson* 11986; Lac Tremblant, Labelle Co., *Victorin & Rolland* 44070; Lake Memphremagog, Sargent's Bay, Aug. 1, 1903, *J. R. Churchill*; Ile Verte, Longueuil, Chambly Co., *Rolland* 43363; McGregor L., *John Macoun* 85530; North Wakefield, *J. M. Macoun* 4358. MAGDALEN ISLANDS: between E. Cape & E. Point, Coffin Island, *Fernald, Long, & St. John* 6763. PRINCE EDWARD ISLAND: east of Britain P., Kings Co., *Fernald & St. John* 10894. NOVA SCOTIA: Pottle's L., North Sydney, Cape Breton Co., *Bissell & Linder*, 19678; west of Ingonish, Cape Breton Island, *Nichols* 749; Salmon R., Truro, Colchester Co., *Bean & White* 19675; Middleton, Annapolis Co., *Fernald & Pease* 19676; Wentworth L., Digby Co., *Fernald & Long* 23130; St. John (Wilson's) L., Yarmouth Co., *Fernald, Bartram & Long* 23129; Charcoal, valley of the East R., *St. John* 1372. MAINE: Portage L., Aroostook Co., 1881, *Kate Furbish*; Great Works Stream, Clifton, Penobscot Co., *Fernald* 2756; Foxcroft, Piscataquis Co., *Fernald* 475; Baker L., T 7 R 17, Somerset Co., *St. John & Nichols* 2106; Swan P., Oxford Co., July 1892, *J. C. Parlin*; Torrey P., Deer Isle, Hancock Co., *A. F. Hill* 2560a; Stevens P., Liberty, Waldo Co., *Rosbach* 60; Black Duck P., Matinicus, Knox Co., July 13, 1919, *C. A. E. Long*; Sydney, Kennebec Co., *Fernald & Long* 12381; n. of Perley P., Sebago, Cumberland Co., *Fernald, Long & Norton* 12382; Wells, York Co.,

July 1881, *J. Blake*. NEW HAMPSHIRE: Cherry P., Jefferson, Coös Co., *Pease* 20073; Long (Stacy) P., Washington, Sullivan Co., *Fernald & Svenson* 745; Frost P., Jaffrey, Cheshire Co., *B. L. Robinson* 494; Derry, Rockingham Co., Aug. 3, 1926, *C. F. Batchelder*; West Lebanon, Sept. 7, 1891, *G. G. Kennedy*; Bellamy R., Madbury, Strafford Co., *Hodgdon* 2640. VERMONT: Pelot's Bay, Lake Champlain, North Hero, Grand Isle Co., Aug. 2, 1899, *Nellie Flynn*; West Barnet, Caledonia Co., Aug. 20, 1884, *F. Blanchard*; Lowell L., Londonderry, Windham Co., *L. A. Wheeler*; Dead Creek, Ferrisburg, Aug. 15, 1881, *E. Faxon*. MASSACHUSETTS: Long P., Tewksbury, Middlesex Co., Aug. 24, 1865, herb. *Boott*, also *L. B. Smith* 632; Lower P., Wakefield, Middlesex Co., *Collins* 937; Plymouth, Plymouth Co., Aug. 26, 1913, *S. N. F. Sanford*; Eastham, Barnstable Co., *Collins* 3171; Sutton, Worcester Co., *Anderson, Smith & Weatherby* 1166; Robinson Creek, Pembroke, *Fernald & Svenson, Gray Exsic.* 409; Lake Buel, New Marlboro, Berkshire Co., July 20, 1920, *J. R. Churchill*. RHODE ISLAND: Providence, July 1866, *G. Thurber*. CONNECTICUT: Twin Lakes, Salisbury, Litchfield Co., *Eames & Godfrey* 8679; Dog P., Goshen, Litchfield, Aug. 24, 1913, *Bissell & Weatherby*; Farmington R., Hartland, Hartford Co., *Ogden & Bolan* 1565; Long P., Thompson, Windham Co., *Weatherby* 4364; Mahoney Meadow, Franklin, New London Co., July 27, 1905, *R. W. Woodward*. NEW YORK: Pierrepont P., Woodville, Jefferson Co., *House* 16979; Lake Canandaigua, Woodville, Aug. 19, 1884, *Morong*; Spencer L., Spencer, Tioga Co., *E. Moore* 1488; Tioughneoga R., Riverside Park, Cortland Co., *E. L. Palmer* 37; Carpenters P., Fabius, Onondaga Co., *House* 1338; Sodus Bay, Wayne Co., *Killip* 6204 & 12258. NEW JERSEY: Black R., Chester, Morris Co., *Mackenzie* 4377; Swartswood L., Sussex Co., *Griscom & Mackenzie* 10685. ONTARIO: Ko-Ko-Ko Bay, L. Timagami, *Cain* 1045; Franks Bay, Lake Nipissing, *Chitty* 260; McKay's L., near Ottawa, *Malte* 118270; McGregor Bay, Manitoulin Dist., *Ogden & Bolan* 1646; Cypress Lake Channel, Tobermory, Bruce Co., *Krotkov* 7038; Little Eagle Harbor, Lake Huron, *John Macoun* 26840; Golden L., Renfrew Co., July 28, 1899, *L. M. Umbach*; Dumbell L., Pancake Pt., Algoma Dist., *Taylor, et al.* 295. MICHIGAN: Isle Royale, *Cooper* 260; St. Ignace, Mackinac Co., *Pease & Ogden* 24165; Lake Charlevoix, Ironton, Charlevoix Co., *Ogden & Bolan* 1676; Bessey Creek, Cheboygan Co., *Gates* 12217; Manistee, Aug. 8, 1882, *Morong*; Pine L. near Mich. Ag. Coll., July 25, 1891, *C. F. Wheeler* 7; Thread P., Flint, Aug. 11, 1909, *Sherff*; Kimble L., Vicksburg, Kalamazoo Co., July 3, 1938, *Rapp* 2238; Barton L., Kalamazoo Co., *Hanes* 1978; Park L., Ingham Co., July 22, 1926, *Oosting*. OHIO: Buckeye L., e. of Columbus, *Morris* A41; Put-in-Bay, Aug. 1898, *A. J. Pieters*. INDIANA: Wolf L., *Agnes*

Chase 1459; Wolf L., Lake Co., *Lansing* 4274; Bear L., Noble Co., *Deam* 49391; Cheesborough L., Flint, Steuben Co., *Deam* 49360; Lake Maxinkuckee, *Evermann* 1032 (US), also *Scovell* & *Clark* 1032 (271), under direction of *Evermann* (F), also *Scovell* 26 (US, mixed with *P. amplifolius*). WISCONSIN: Elkhart L., Aug. 28, 1887 and Aug. 4, 1892, *F. H. Schuette*; Pell L., Bloomfield Twp., Walworth Co., *Hotchkiss* & *Koehler* 4193; Lauderdale, *Bebb* 995 & 1008; Valley of the Wisconsin R., near Rainbow Rapids, *Cheney* 1420. ILLINOIS: Lake Villa, Lake Co., *Gleason* & *Shobe* 179; Grass L., Lake Co., *Gates* 1752.2; Cedar L., 50 mi. n. of Chicago, *Roush* 812; Ringwood, *Geo. Vasey*. MINNESOTA: Lake Itasca, Clearwater Co., *Grant* & *Oosting* 3203; Cass L., *Pammel* 100; Minnesota R., Dakota Co., June 1895, *E. P. Sheldon*; Great Crab L., St. Louis Co., Sept. 3, 1919, *Butters*; Green L., Chisago City, *Metcalf* 1295; Swan L., Nicollet Co., *Metcalf* 50; Schultz L., Kandiyohi Co., *Metcalf* 2113; Koronis L., Stearns Co., *Metcalf* 1388, also *Kubichek* 115b (US, mixed with *P. amplifolius*); Little Pine L., Aitkin Co., *Over* 17139; Lizzie L., Ottertail Co., *Kubichek* 190; Bear L., Freeborn Co., *Shunk* & *Manning* 83; German L., Le Sueur Co., *Shunk* & *Manning* 225; Lake Charlotte, Wright Co., *Linsdale* & *Keck* 127; Silver L., Mille Lacs Co., Aug. 1892, *E. P. Sheldon*. IOWA: Spirit L., Dickinson Co., July 31, 1896, *B. Shimek*, also July 29, 1897, *R. I. Cratty*; Round L., Lake Twp., Clay Co., *Hayden* 823. NORTH DAKOTA: Upsilon L., Turtle Mts., St. John, Rolette Co., *Mabbott* 459; Metigoshe L., Turtle Mts., Bottineau Co., *Metcalf* 544. NEBRASKA: Hannah's L., Cherry Co., *Smith* & *Pound* 228; Hackberry L., Cherry Co., July 20, 1912, *Pool* & *Folsom*, also *Tolstead* 638; Niobrara Game Reserve, near Valentine, *Tolstead* 428; Swan L., Grant Co., *Rydberg* 1652; Shafer L., Garden Co., *Uhler* & *Martin* 1660; South Cody L., *Ray Thomson* 232. ALBERTA: n. of Lake Louise, Rocky Mts., *Macoun* 68425 (C). MONTANA: Lake McDowell, Glacier Nat'l Park, *Maguire* & *Piranian* 5439; Avalanche L., Glacier Nat'l Park, *Standley* 18500; Rost L., Big Fork, *Whitford* 254, also *MacDougal* 676; Whitefish L., Aug. 24, 1892, *R. S. Williams*. IDAHO: Lake Pend Oreille, near Hope, *Sandberg*, *MacDougal* & *Heller* 939; Lake Pend Oreille, Aug. 1891, *J. B. Leiberg*; valley of Lake Tesemini, Kootenai Co., *Sandberg*, *MacDougal* & *Heller* 697; Paradise Creek, Moscow, *Henderson* 2717; Priest L., *Piper* 3765, also *MacDougal* 240; Potlatch R., Nez Perce Co., *St. John et al.* 9740; Warm L., 25 mi. n. e. of Cascade, Valley Co., *Rollins* & *Chambers* 2590; Fernan L., Coeur d'Alene, *Rust* 385. WYOMING: Jackson's Hole, Lincoln Co., *E. B. & Lois B. Payson* 2251; Grand Encampment, *Aven Nelson* 4145. COLORADO: Laramie R., Larimer Co., Aug. 4, 1891, *C. S. Crandall* (NY); Crested Butte, Aug. 1891, *Cal. Acad. Sci. Herb.* (S). UTAH: Weber R., *Sereno Watson* 1131 (G, see also next citation). NEVADA: Ruby

L., *Sereno Watson* 1131 (G, NY, US, see also previous citation). NEW MEXICO: Long L., Chusca Mts., San Juan Co., *A. Wetmore* 541 (US). ARIZONA: Marsh L., White Mts., *Goldman* 2453 (US); Walker L., San Francisco Mts., *Knowlton* 288 (US). CALIFORNIA: Fletcher Creek at Pease Place, Devil's Garden, Modoc Co., *L. C. Wheeler* 3973; near Lassen Buttes, Plumas Co., *H. E. Brown* 644; Upper Mud L., Coal Mine Ridge, San Mateo Co., *R. S. Ferris* 2043; Mather, Tuolumne Co., *Keck* 1188; Lakeside, Eldorado Co., June, July 1912, *H. D. Geis*; Lily L., near Fallen Leaf, Lake Tahoe region, Eldorado Co., *Wiggins* 6757, 6777 & 6797; Big Lagoon, Big R., Mendocino Co., *McMurphy* 193; Bear Valley, San Bernardino Mts., *S. B. & W. F. Parish* 1435. OREGON: Salem, *Elihu Hall* 486; Sauvie's Island, Willamette, Multnomah Co., *Howell* 365; Seven Mile Creek, Klamath L., Klamath Co., *Applegate* 4489; w. fork of Illinois R., near Floyd School, Josephine Co., *Abrams* 8677; Port Orford, *Peck* 8514; Quartz Valley, *Coville & Leiberg* 224 & 228; Cape Arago, Coos Co., *House* 5044. WASHINGTON: first pond east of summit, Nespelem road, Okanogan Co., *Fiker* 1455; Oyhut, Chehalis Co., *Lamb* 1259; Nooksack R., Lummin Indian Reservation, Whatcom Co., *Muenschner* 7643; Seattle, *Piper* 758. BRITISH COLUMBIA: Revelstoke, *John Macoun* 3019; Colquitz R., near Victoria, *John Macoun* 88248; San Juan L., Dist. of Renfrew, *Rosendahl* 790; Chilliwack Valley, *J. M. Macoun* 26814; Griffin L., *Macoun* 2971 (C, mixed with *P. epihydrus* v. *Nuttallii*), also *Macoun* 3020. ALASKA: Prince of Wales Island, Klawak L., *Mr. & Mrs. E. P. Walker* 994; Ketchikan, *Cowles* 1405; Dundas Bay, *J. P. Anderson* 1344; Sitka, *J. P. Anderson* 21, also *Evans* 781.

P. natans is a familiar species over all the northern half of the United States. Because of its wide range and tendency to fruit freely it is one of the primary foods for wild water-fowl.

Although the American plant seldom attains the robustness so typical of the European plant, there seem to be no characters fundamental enough to separate the two, even as varieties. The fruit of the American plant has a weaker endocarp-beak than that of the European, a fact noted for the American *P. alpinus*, but unlike the case of that plant, the drying of the mesocarp of *P. natans* does not cause any appreciable difference in the shape of the fruits on the two hemispheres. The endocarp loop is invariably solid in the American plant and sometimes shows a cavity in European specimens.

P. natans, like the other broad-leaved species, responds markedly to ecological conditions. Many of these forms have been given names. In fact, some of the names on the labels for

the European plants make habitat-notes quite superfluous. When in quiet water, the floating leaf-blades become broad and definitely cordate; when in a current, the blades are narrower and rounded or cuneate at the base. Flowing water also causes an elongation of the internodes and a marked reduction in the production of inflorescences.

An aquarium plant of *P. natans*, which grew from a seed in my laboratory, showed an interesting sequence of development. The first shoot produced only the linear submersed leaves; the second shoot produced some broad leaves, which were much narrower than normal and narrowly cuneate at base; the third shoot produced the typical broad floating leaves which were cordate at base. Then a number of shoots were sent up at about the same time, the floating leaf-blades of which, however, reverted to the narrow type with cuneate bases. Finally, the branching rhizome sent up numerous shoots, all of which produced submersed leaves only, or a few leaves with slightly dilated tips. Thus from one seed were produced forma *submersus* Glück, var. *prolixus* Koch, and var. *vulgaris* Koch & Ziz (var. *typicus*). The aquarium was not so constructed that var. *terrestris* S. F. Gray might appear.

An interesting form of *P. natans* which grew in the tidal water of Robinson Creek, Pembroke, Massachusetts, has been observed on several occasions by Prof. Fernald, and as it appeared to remain the same, was collected by Fernald and Svenson and distributed from the Gray Herbarium. With its reduced floating leaf-blades, narrowly cuneate at base, on long petioles, and its production of winter buds (collected in October), this is obviously an ecological state. Mr. Weatherby kindly drove me to the locality, but so many changes, attendant on the building of a paved road and a new bridge, have so altered the locality as described by Prof. Fernald that no *P. natans* was found. In such a habitat, where the tidal water rises and lowers twice a day and perhaps at times becomes slightly brackish, no fresh-water species of *Potamogeton* can be expected to lead a normal life. That the floating leaves of this plant were submersed at times is evidenced by the non-functional and reduced number of stomates.

Fryer's remarks on "some beautiful seedling forms of *P.*

natans, with lanceolate, oval, and round floating leaves, sufficient to afford examples of several named 'varieties', but unfortunately all growing on *one rootstock* in the instance in which the 'varieties' were most marked!" are of interest here.

American plants labeled "var. *prolixus*" include juvenile and elongated forms of *P. natans* and elongated forms of *P. Oakesianus*. They are always sterile.

8. *P. OAKESIANUS* Robbins

RHIZOMES whitish with red spots. STEM often branched, terete, .5-1 mm. in diameter; stele with the trio-type pattern, the phloem on the inner face of the trio-bundle appearing as 2 patches; endodermis well developed, of U-cells; interlacunar and subepidermal bundles present; pseudohypodermis absent or 1 cell thick. SUBMERSED LEAVES delicate, narrowly linear, obtuse, 5-16 cm. long, (.25-) .3-1 mm. wide; nerves 3. FLOATING LEAVES coriaceous, with long petioles .2-1 mm. thick; blades ovate-elliptical to oblong-elliptical, rounded or tapering at base, obtuse, (1.5-) 2-4 (-5.5) cm. long, 1-2 (-3) cm. wide; nerves (7-) 9-19 (-23), about one-third of them prominent; lacunae none or obscure. STIPULES of the submersed leaves clasping the stem, whitish, delicately fibrous, persistent but becoming shreddy, linear, acutish when dry, about 1-3 cm. long; those of the floating leaves larger, 2-4 (-5.5) cm. long, linear or narrowly triangular, strongly fibrous, 2-keeled, at least at base. PEDUNCLES thicker than the stem, .9-1.6 mm. in diameter, 2.5-6 cm. long. SPIKES with 3-8 whorls; in fruit 1-3.5 cm. long, .7-.9 cm. thick. FLOWERS sessile or nearly so; sepaloid connectives 1.3-1.8 (-2.2) mm. wide; anthers about .8 mm. long. FRUITS obovoid, 2.5-3.5 (3.7) mm. long, (1.6) 2-2.4 mm. wide; lateral keels rounded, dorsal keel usually prominent and acutish; beak short and broad; exocarp smooth or nearly so, greenish or rarely buff; endocarp with smooth sides, and with 2 rather deep sinuses on the back forming 3 obtuse keels, beak linear, about .8 mm. long, loop solid; apex of seed pointing a little above the basal end. Plants similar to *P. natans* but smaller.

P. Oakesianus Robbins in Gray, Man. Bot. ed. 5: 485 (1867); Morong, Mem. Torr. Club 3: no. 2: 14 (1893); Taylor, N. Am. Fl. 17: pt. 1: 16 (1909); Hagström, Crit. Res. Pot. 196 (1916). *P. Purshii* Tuckerm. sensu Graebn. in Engler, Pflanzenr. 4: fam. 11: 45 (1907); ? Tuckerm., Amer. Journ. Sci. ser. 2: 6: 228 (1848), see Fernald, Mem. Am. Acad. Arts & Sci. 17: pt. 1: 121 & 122 (1932).

Shallow pools and edges of quiet ponds, Newfoundland, Anticosti, Magdalen Islands, Nova Scotia, eastern New Brunswick,

Maine, south to New Jersey, west to central New York, and local in Michigan, Wisconsin, and western Ontario. MAP 9. NEWFOUNDLAND: Quirpon Island, Straits of Belle Isle, *Wiegand, Gilbert & Hotchkiss* 27339; Grand Falls, *Fernald, Wiegand & Darlington* 4464 & 4465; Blomidon ("Blow-me-Down") Mts., *Fernald & Wiegand* 2436; Lookout Mt., Bonne Bay, *Fernald, Long & Fogg* 1208; McClellan's P., Crabbes, *R. B. Kennedy* 543; Port aux Basques, *Fernald, Long & Dunbar* 26217. QUEBEC: Les Trois Lacs, Laurentides, *Victorin, Rolland & Jacques* 33639; Rivière Noire, Portneuf Co., *Rousseau* 25814; Matamek R. Dist., North Shore, *Bowman* 392. ANTICOSTI: Ellis Bay, *Macoun* 2993. MAGDALEN ISLANDS: Coffin Island, *Fernald, Long & St. John* 6764 & 6765; Cap-de-l'Est, Ile de la Grande-Entrée, *Victorin & Rolland* 9922. NEW BRUNSWICK: Lac Fox Creek, Westmorland Co., *Victorin, Rolland & Jacques* 44749; Lily P., Southern Head, Grand Manan, Charlotte Co., *Knowlton & Weatherby* 6632. NOVA SCOTIA: Taylor's L., Sunny Brae, Pictou Co., *St. John* 1373; Clyde R., Shelbourne Co., *Prince & Atwood* 1318 (S); Goose L., Argyle, Yarmouth Co., *Fernald & White* 19680; Petpeswick, Musquodoboit Harbour, Halifax Co., *Rousseau* 35293; Five-Island L., Hants Co., *Fernald, Bartram & Long* 23131; Lena L., St. Paul Island, *Perry & Roscoe* 38. MAINE: Haley P., Rangeley, Franklin Co., Sept. 1, 1894, *Furbish*; Gilead, Oxford Co., 1897, *Furbish*; Jordan P., Hancock Co., Sept. 10, 1898, *E. L. Rand*; Hackmatack Swamp, Isle au Haut, Knox Co., *A. F. Hill* 1222; Southport, Lincoln Co., *Fassett* 18803; Perley P., Sebago, Cumberland Co., *Fernald, Long & Norton* 12384; Lily P., East Limington, Limington, York Co., *Fernald, Long & Norton* 12383. NEW HAMPSHIRE: Connecticut R., Northumberland, Coös Co., *Pease* 12171; Wheeler P., Shelbourne, Coös Co., Aug. 31, 1918, *Deane*; Merrimack, Hillsboro Co., June 19, 1918, *Batchelder*; Stonehouse P., Barrington, Strafford Co., *Hodgdon* 599. VERMONT: Grout P., Stratton, Windham Co., *Eggleston* 2111; also Sept. 1, 1931, *R. J. Eaton*. MASSACHUSETTS: So. Natick, Middlesex Co., Sept. 15, 1881, *Morong*; Wellesley, Norfolk Co., July 20, 1908, *Wiegand*; Plymouth, Plymouth Co., June 24, 1895, *J. W. Blankinship*; Wellfleet, Barnstable Co., *Fernald & Fogg* 505; pond between Lizzie's P. and Goose P., Chatham, Barnstable Co., *Fernald* 15955; Edgartown, Dukes Co., *Seymour* 1487; Nantucket, Nantucket Co., 1886, *L. L. Dame*; Uxbridge, Worcester Co., Aug. 28, 1851, (TYPE in herb. N. Y. Bot. Gard., cotypes in F, G, NE) and Aug. 18, 1870, *Robbins*, also June 5, 9, & 24, 1876, *Morong*; Lake Chaubunagungamaug, Webster, Worcester Co., *Ogden & Bolan* 1562; Spectacle P., Sandisfield, Berkshire Co., June 29, 1912, *R. Hoffmann*. CONNECTICUT: Middlebury, New Haven Co., Sept. 14, 1901, *Harger*; Stafford, Aug. 1897, herb. *E. L. Morris*. NEW

YORK: Quiver P., Fourth L., Fulton Chain, Adirondack Mts., *Killip 12574* (US, mixed with *P. epihydrus* v. *Nuttallii*, G, not mixed); Brandy Brook Flow, Cranberry L., St. Lawrence Co., *Muenschner & Maguire 1711*; Big Moose L., Herkimer Co., *Muenschner & Maguire 1716*; Fall Creek, Tompkins Co., *Dudley*; Deep P., Wading R., Long Island, *E. S. Miller*; Rock P., Adirondacks, Aug. 5, 1884, *Morong*; McDonough, July 26, 1886, *F. V. Coville*. NEW JERSEY: Pump Branch of Albertson Brook, Ancora, Camden Co., *J. W. Adams 511*; Magnolia L., Ocean View, Cape May Co., Sept. 29, 1921, *H. B. Meredith*; Estellville, Atlantic Co., July 4, 1883, *C. A. Gross*. ONTARIO: Sand Pt., Algoma Dist., Lat. 47° 00' N., Long. 84° 45' W., *Taylor et al. 297* (C). MICHIGAN: bog near Rock R., Alger Co., *Fernald & Pease 3066*; Au Train, Alger Co., *Pease & Ogden 25135*; Crooked L., Clyde Twp., Allegan Co., Aug. 18, 1937, *D. L. Allen*; Crooked L. Marsh, Allegan Co., Aug. 4, 1938, *W. G. Erwin*; ½ mi. s. w. of West L., Portage Twp., Kalamazoo Co., *Hanes 407*. WISCONSIN: Potter's Cranberry Farm, Cutler, Juneau Co., Sept. 23, 1932, *J. H. Steenis* (G); Valley of the Wisconsin R., near Grand Rapids, *Cheney 3610* (NY).

P. Oakesianus has the general appearance of *P. natans* except that it is uniformly smaller in all its parts. There are fundamental differences, however, chiefly in regard to the fruit. The fruit, besides being smaller, lacks the puckered, buff epicarp of *P. natans* and is, instead, stretched and smooth and usually green. The fruits also differ from those of *P. natans* by having 3 prominent keels. The other differences are mainly those correlated with size. While the submersed leaves of *P. natans* are generally borne on the single main stem, those of *P. Oakesianus* are on branches.

9. *P. GRAMINEUS* Linnaeus (American varieties)

RHIZOME buff, often suffused or spotted with red, variable in thickness. STEM much branched, terete .5–1 mm. in diameter; stele with the oblong-type pattern with but 1 central bundle (rarely with 2) and usually but 1 lateral bundle on each side; endodermis of U-cells strongly thickened on the inner and lateral faces; interlacunar bundles strongly developed but only in the outer interlacunar circle; subepidermal bundles present or absent; pseudo-hypodermis absent or 1 cell thick. SUBMERSED LEAVES linear to linear-lanceolate or lance-elliptical (sometimes oblanceolate), 1–9 (–13) cm. long, (.1–) .2–1 (–1.5) cm. wide, tapering gradually to a sessile base; apex acute, usually sharp-pointed; nerves 3–9 (–11); lacunae of 1 or 2 rows along

midrib, mostly obscure; margins with fugacious 1-celled translucent denticles. FLOATING LEAVES coriaceous, blades ovate to elliptical (rarely subrotund), 1.5–5 (–7) cm. long, 1–2 (–3) cm. wide; apex obtuse or bluntly mucronate; base cuneate or rounded; petioles 2–10 (–15) cm. long, mostly longer than the blades; nerves 13–17 (–23); lacunae obscure. STIPULES persistent, obtuse and slightly cucullate at apex, those of the submersed leaves and branches .5–3 cm. long, 1–2 mm. wide at base, faintly 2-keeled, with 8 to 30 finer nerves, those of the floating leaves broader. PEDUNCLES at base about same thickness as stem, sometimes clavate, 2–10 (–30) cm. long. SPIKES in anthesis usually rather compact, of 5–10 whorls of flowers; in fruit cylindric and crowded, 1–2.5 cm. long, .6–.8 cm. thick. FLOWERS sessile or on pedicels up to .5 mm. long; sepaloid connectives orbicular to oval, blades (.7–) 1.2–1.6 (–2.3) mm. wide, claws (.2–) .4–.8 (–1) mm. long; anthers oblong .6–1 (–1.1) mm. long. FRUITS mostly obovate, 1.7–2.5 (–2.8) mm. long (excluding beak), (1.4–) 1.6–2 (–2.3) mm. wide, keels usually strongly evident, but often obscured by the loose exocarp, beak facial, short and curved toward the back; exocarp usually loose, green or rarely tawny; endocarp with keels low and obtuse, beak linear, weak, .3–.5 mm. long, loop solid; apex of seed pointing .3–.7 mm. above the basal end. A variable species characterized by a stem with many lateral compound branches bearing numerous small leaves. Among the many variants of *P. gramineus*, the following seem worthy of recognition:

1. Principal submersed leaves narrowly elliptic to oblanceolate, (1–) 1.5–9 (–13) cm. long, .2–1 (–1.5) cm. wide, 5–10 times as long as broad, or if more than 10 times, then not less than 6 cm. long, sides not parallel; nerves (3–) 5–9.
2. Principal submersed leaves (1–) 1.5–4.5 (–6.5) cm. long, .2–.6 (–.8) cm. wide; nerves 5–7.....9a. var. *typicus*.
2. Principal submersed leaves (3–) 6–9 (–13) cm. long, .6–1 (–1.5) cm. wide; nerves 7–9 (–11).....9b. var. *maximus*.
1. Principal submersed leaves linear, (1–) 1.5–3.5 (–5.5) cm. long, .1–.25 (–.3) cm. wide, 10–20 (–30) times as long as broad, sides essentially parallel for most of their length, tapering at apex to an acute tip; nerves 3.....9c. var. *myriophyllus*.

9a. *P. GRAMINEUS* L. var. *typicus*

P. gramineus L., Sp. Pl. 1: 127 (1753); Graebn. in Engler, Pflanzenr. 4: fam. 11: 84 (1907). *P. Proteus heterophyllus* C. & S., Linnaea 2: 202 (1827). *P. gramineus* var. *graminifolius* Fries, Novit. Fl. Suecicae 36 (1828), and subsequent Am. authors. *P. heterophyllus* sensu Morong, Mem. Torr. Club 3: no. 2: 23 (1893); Taylor, N. Am. Fl. 17: pt. 1: 19 (1909); not Schreb. *P. heterophyllus* forma *graminifolius* Morong, Mem. Torr. Club 3: no. 2: 24 (1893). *P. heterophyllus* forma *longipedunculatus* Morong,

Mem. Torr. Club **3**: no. 2: 24 (1893), at least in part. *P. gramineus* var. *longipedunculatus* Graebn. in Engler, Pflanzenr. **4**: fam. 11: 88 (1907). *P. heterophyllus* forma *terrestris* Robinson & Fern., Gray's Man., ed. **7**: 74 (1908). *Spirillus heterophyllus* Nieuwl., Am. Mid. Nat. **3**: 17 (1913). *P. gramineus* forma *longipedunculatus* House, Bull. N. Y. State Mus. **254**: 53 (1924), at least in part. *P. gramineus* forma *terrestris* Carpenter, Fl. Vt., 3rd rev. ed.: 25 (1937). *P. gramineus* var. *lacustris* sensu Hultén, Fl. Alaska and Yukon, pt. 1: 100 (1940).

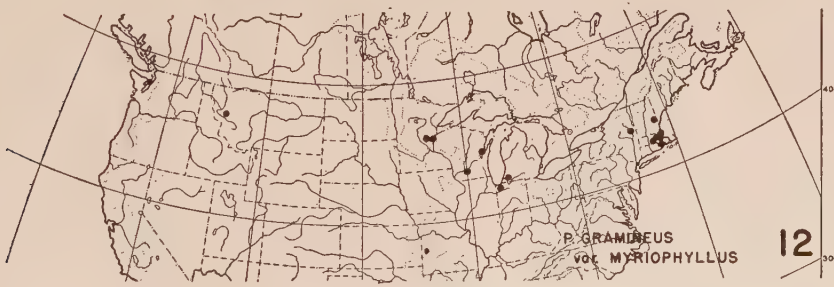
Lakes and streams, southern Greenland to Alaska, south to New Jersey, Ohio, Indiana, Illinois, Iowa, Nebraska, New Mexico, Arizona, and California. MAP 10. Eurasia. Of the very numerous collections of this variety the following are the most typical in the areas cited: GREENLAND: Igaliko, 1828, *J. Vahl*, also July 23, 1888, *Rosenvinge* 2990; Igaliko-Fjord, *Qags-siarssuk*, Aug. 5, 1925, *A. E. & M. P. Porsild*; Frederiksdal, July 25, 1925, *A. E. & M. P. Porsild*. NEWFOUNDLAND: Bear Cove, Straits of Belle Isle, *Wiegand & Pease* 27340; Flower Cove, Straits of Belle Isle, *Fernald & Long* 27345; Birchy Cove (Curling), *Fernald, Wiegand & Kittredge* 2445 & 2447; Bonne Bay, Main R., *Fernald & Long* 1210; Highlands Brook, Crabbes, *Kennedy* 82. QUEBEC: Lake Mistassini, *Macoun* 2980 & 2984; Trout P., mouth of Grand R., *Collins, Fernald & Pease* 4013½, 5287, 5314 & 5314A; Lotbiniere, Lotbiniere Co., *Victorin, Rolland & Jacques* 33714; New Richmond, Bonaventure Co., *Victorin, Rolland & Jacques* 33855; Lake Temiscouata, *Victorin* 526; Farm Point, Gatineau R., *J. M. Macoun* 80929; Ottawa R. at Gatineau Point, *Malte* 118257; Blue Sea L., *Malte* 118265; Lac Wattopekah, St. Georges de Windsor, Richmond Co., *Louis-Marie, Laporte & Dudemaine* 1403; Black L., Megantic Co., *Fernald & Jackson* 11988. ANTICOSTI: Ruisseau Harvey, Aug. 17, 1917, *Victorin* 4195. MAGDALEN ISLANDS: Amherst Island, *St. John* 1758 (toward var. *maximus*). NOVA SCOTIA: Warren L., Cape Breton I., *Nichols* 876; George R., Cape Breton I., *Bissell & Linder* 19692; Little R., Tiddville, Digby Co., *Fernald & Long* 19690. NEW BRUNSWICK: Nerepis R., Westfield, Kings Co., *Fernald* 1619; Hammond R., Hammond, Kings Co., *Senson & Fassett* 3046; Lake Utopia, *Wetmore* 2988; Little Tobique L., *Hay* 2989. MAINE: Fort Fairfield, Aroostook Co., *G. D. Chamberlain* 1770; Fish River L., Aroostook Co., *Ogden* 1716; Pushaw P., Glenburn, Penobscot Co., *Ogden & Steinmetz* 1545; Indian P., St. Albans, Somerset Co., *E. C. & Edith B. Ogden* 2013; Pitcher P., Northport, Waldo Co., *Ogden & Steinmetz* 1612; Wilson P., Wilton, Franklin Co., *Ogden & Marston* 1698; Presumpscot R., North Windham, July 9, 1899, *W. C. Kendall*. NEW HAMPSHIRE: Dead R., Berlin, Coös Co., *Pease* 22754; Lake Winnipisaukee near Melvin Village, Aug. 15, 1904,

M. A. Day. VERMONT: Little Otter Creek, Lake Champlain, Ferrisburg, Aug. 7, 12, and 20, 1880, *C. E. Faxon*; Queechee Gulf, July 29, 1890, *G. G. Kennedy*; Fairfield P., Fairfield, Franklin Co., *Blake 3071*. MASSACHUSETTS: Mystic L., July 4, 1852, *Robbins*; Fresh P., Cambridge, August 6, 1883, *Morong*; Sandy P., Lincoln, Sept. 15, 1868, herb. *Wm. Boott*; Natick, Aug. 14 and 17, 1883, *Morong*. CONNECTICUT: Selden's Cove, Lyme, Aug. 31, 1900, *C. B. Graves*; Pistapaug P., Durham, *Weatherby 3389*; several collections from Lake Saltonstall, E. Haven are typical *P. gramineus*, others from the same lake approach var. *myriophyllus*, still others approach var. *maximus* or are perhaps *P. gramineus* × *P. illinoensis*. NEW YORK: Butterfield L., Jefferson Co., *Muensch & Maguire 1690*; Osgood P., Franklin Co., *Muensch & Maguire 778*; Otsego L., Otsego Co., *Muensch & Curtis 4880*; Bullhead P., Minerva, Essex Co., *House 15193*; Myers Pt., Ludlowville, Tompkins Co., Aug. 13, 1884, *W. R. Dudley*. NEW JERSEY: Morris P., Sept. 13, 1887, *N. L. Britton*; Morris L., Aug. 10, 1894, herb. *W. M. Van Sickle*; Lake Hopatcong, Morris Co., *C. F. Austin* (C, mixed with *P. gramineus* var. *maximus*; NY, not mixed); Swartzwood L., Sussex Co., *Griscom & Mackenzie 10686*. ONTARIO: Belleville, *Macoun 2985*; Great Opeongo L., Algonquin Park, *Macoun 22216 & 22217*; McGregor Bay, Manitoulin Dist., *Ogden & Bolan 1644 & 1645*; near Dyer Bay, Bruce Pen., *Pease & Ogden 24911*; Gillies L., Bruce Pen., *Cain 938*; Ko-Ko-Ko Bay, Lake Timagami, *Cain 1039 & 1042*. MICHIGAN: Isle Royale, *Cooper 69*; Seneca L., Keweenaw Co., *Hermann 8286*; Brevort L., Moran, Mackinac Co., *Ogden & Bolan 1680*; Lake Charlevoix, Ironton, Charlevoix Co., *Ogden & Bolan 1677*; Crystal L., Montcalm Co., July 1900, *C. F. Wheeler*; Manistee, Aug. 14, 1884, *Morong*; Pearl L., Benzie Co., *McAtee 3076*. OHIO: Sandusky Bay, July 20, 1895 and Sept. 2, 1898, *E. L. Moseley*; Put-in-Bay, Aug. 1898, *A. J. Pieters*. INDIANA: Wolf L., Hammond, *Agnes Chase 1707*; Clarke, Aug. 28, 1897 and June 29, 1898, *L. M. Umbach*; Lake Maxinkuckee, *Scovell 44*, also *Scovell & Clark 1221*, also *Evermann 1221*. WISCONSIN: Pell L., Bloomfield Twp., Walworth Co., *Hotchkiss & Koehler 4194*; near State House, Trout Lake, Vilas Co., *Fassett 9067 & 9069*; Green Bay, Big Suamico, Aug. 28, 1891 and July 31, 1893, *J. H. Schuette*. ILLINOIS: Edgewater, June 7, 1890, *L. N. Johnson*; Rogers Park, June 7, 1890, herb. *W. H. Dunham*. MANITOBA: 4 mi. w. of Hamiota, *Macoun & Herriot 76868*; Killarney, *Macoun 16441*. MINNESOTA: Green L., Kandiyohi Co., *Metcalf 2050*; Itasca Park, De Soto L., Becker Co., *Grant & Oosting 3272 & 3276*; Snail L., Ramsey Co., *Oosting 28166*; Horn L., Anoka Co., *Oosting 291 & 28100*; Muskeg Bay, Lake of the Woods, Warroad, Roseau Co., *Hotchkiss & Jones 417*; Long L. near Ely, St. Louis Co., *Hotchkiss & Jones 4083*; Pleasant L.,

Stearns Co., *Linsdale & Keck* 1; Dudley L., Rice Co., *Keck & Stilwell* 373 & 379; Birch L., Sherburne Co., *Kubichek* 101; Fish L., Chisago Co., *Kubichek* 66; Borden L., Garrison Twp., Crow Wing Co., *Hotchkiss & Jones* 4112. IOWA: Armstrong, Emmet Co., Aug. 8, 1891, June 20, 1897, and Aug. 21, 1897, *R. I. Cratty*; Lost Island L., Freeman Twp., Clay Co., *Hayden* 821. NORTH DAKOTA: King Slough, s. of Bismark, *Metcalf* 345; Doctor L., Drake, *Mabbott* 423; Spiritwood, *Bergman* 443; Leeds, Benson Co., Aug. 2, 1899, Aug. 21, 1899, and Aug. 16, 1915, *J. Lunell*. SOUTH DAKOTA: South Bass P., Cottonwood L., Spink Co., *Over* 17138; eastern Day Co., *Over* 14466. NEBRASKA: Pelican L., *Thomson* 153; Red Willow L., *Thomson* 361 & 365; Enders L., *Thomson* 16; Dewey L., *Tolstead* 615; Shafer L., Garden Co., *Uhler & Martin* 1656. MACKENZIE: Mosquito Creek and Driftwood R., Great Bear L., 66° 55' N. 121° 20' W., July 6-8, 1928, *A. E. & R. T. Porsild*; Edna Travers Bay, Great Bear L., 66° 25' N. 117° 40' W., *A. E. & R. T. Porsild*. SASKATCHEWAN: vicinity of William Pt., Lake Athabasca, 59° 7' 30" N. 109° 19' W., *Raup* 6849; Little Buffalo L., *J. M. Macoun* 2975; s. of Battleford, *Macoun* 2981. ALBERTA: east end of Crow's Nest Pass, Rocky Mts., *Macoun* 23180; Sand Pt., n. shore of Lake Athabasca, *Raup & Abbe* 4614. MONTANA: Mud L., Bigfork, Flathead L., *M. E. Jones* 9293; Flathead L., Big Fork, Flathead Co., *G. B. & R. P. Rossbach* 17; Whitefish L., Aug. 24, 1892, *R. S. Williams*; Lower Two Medicine Lakes, Glacier Nat'l Park, *Maguire* 484; Echo L., *MacDougal* 639. IDAHO: Priest L., *MacDougal* 241; Lake Pend Oreille, *Sperry & Martin* 719, also *Henderson* 4576; Lake Pend Oreille, near Hope, *Sandberg, MacDougal & Heller* 955 & 1026. WYOMING: Shoshone Creek, Yellowstone, Aug. 23, 1878, *C. Richardson*; Yellowstone L., Yellowstone Park, *Tweedy* 411; Leighs L., Jacksons Hole, *Merrill & Wilcox* 902. COLORADO: Estes Park, Lorimer Co., *Beetle* 2341; South Park, *Wolf* 961; near Boulder, Boulder Co., *Tweedy* 4978. UTAH: Grassy L., Goodman Ranch, Bear R. valley, Uinta Mts., Summit Co., *Hermann* 5781. NEVADA: Ruby L., *Watson* 1134. NEW MEXICO: Petersen Reservoir, Montezuma (Hot Springs), San Miguel Co., *Drouet & Richards* 3309; Chusca Mts., San Juan Co., *Wetmore* 550; Dark Canyon, Guadalupe Mts., *Standley* 40649. ARIZONA: Mormon L., *MacDougal* 80 (toward var. *maximus*). CALIFORNIA: Little Hot Springs Valley, Modoc Co., Aug. 18, 1899, *M. S. Baker*; vicinity of Truckee, *A. E. Hitchcock* 260; Truckee R. watershed, Sierra Nevada range, *Benson* 4013. OREGON: Bear Flat, Lake Co., *Leiberg* 751; Guano Ranch, Lake Co., *Coville* 602. WASHINGTON: Lake Washington, Mercer Island, King Co., *Thomson* 7589; Ozette L., Clallam Co., *Otis* 1584; Blakeley Island, San Juan Islands, *S. M. & E. B. Zeller* 1237; Falcon Valley, Aug. 1, 1885, *W. N. Suksdorf* (toward



10



12

RANGES OF POTAMOGETON

var. *myriophyllus*). BRITISH COLUMBIA: Kamloops, Macoun 2974; Wellington, Vancouver Island, John Macoun 88254; Sproat L., Albernie, Vancouver Island, Carter 505. ALASKA: Yes Bay, Howell 1668; Fairbanks, L. J. Palmer 1866.

9b. *P. GRAMINEUS* L. var. *MAXIMUS* Morong ex Bennett

Var. *maximus* Morong ex Bennett, Journ. Bot. **19**: 241 (1881). *P. lonchites* Tuckerm., Am. Journ. Sci. ser. 2: **6**: 226 (1848), not Tuckerm., *ibid* ser. 2: **7**: 350 (1849) and subsequent Am. authors. *P. gramineus* var. *maximus* Morong, Bull. Torr. Club **13**: 155 (1886), without description. *P. heterophyllus* forma *maximus* Morong, Mem. Torr. Bot. Club **3**: no. 2: 25 (1893). *P. gramineus* var. *maximus* Graebn. in Engler, Pflanzenr. **4**: fam. 11: 88 (1907). *P. heterophyllus* in part, Taylor, N. Am. Fl. **17**: pt. 1: 19 (1909). *P. gramineus* f. *Wolfgangii* sensu Hagstr., Crit. Res. Pot. 209 (1916), as to American citations. *P. gramineus* f. *jemtlandicus* sensu Hagstr., Crit. Res. Pot. 209 (1916), as to American citations.

Lakes and streams, often in flowing water, with the typical variety and having essentially the same range in North America. MAP 11. Among many collections, the following are the most representative from the areas cited: LABRADOR: 18 mi. up Naskaupi R., Lake Melville Dist., R. H. Wetmore 103096. NEWFOUNDLAND: Rushy P., Exploits R., Fernald, Wiegand, Bartram & Darlington 4477; Lewisport, Notre Dame Bay, Fernald, Wiegand & Darlington 4480. QUEBEC: Lac des Quinze (Baie Gilies), Temiscaming-Abitibi, Victorin 8194 & 8195; Roberval, July 16, 1892, Geo. G. Kennedy; Deschenes, near Hull, Malte 118263; Lac Saint-Jean, Victorin 16064. ANTICOSTI: Rivière McKane, Victorin & Rolland 27095; Pointe de l'Est, Victorin & Rolland 27094. NEW BRUNSWICK: Titusville, Brittain 2987; near St. John R., Connors, Pease 2589. NOVA SCOTIA: Salmon R., Truro, Colchester Co., Bean & White 22962. MAINE: Aroostook R., Ft. Fairfield, July 18, 1893, Fernald; St. John R., Ft. Kent, Mackenzie 3613; Dead R., Somerset Co., Fernald & Strong 477; stream below Dwinall P., Winn, Penobscot Co., Steinmetz 365; Stillwater R., Old Town, Penobscot Co., Ogden & Steinmetz 1602; Orland R., Orland, Penobscot Co., Ogden & Marston 1694. NEW HAMPSHIRE: Connecticut R., Walpole, Fernald 436; Connecticut R., near Hanover, July 26 and Aug., 1876, H. G. Jesup (not typical). VERMONT: Little Otter Creek, Lake Champlain, Aug. 7, 1880, herb. E. & C. E. Faxon (not typical). MASSACHUSETTS: Charles R., Dedham, July 14, 1879 and July 16, 1880, Morong, also Aug. 2, 1880, C. E. Faxon; Charles R., S. Natick, July 14, 1879 and Sept. 5, 1882, Morong; Charles R., Needham, Tuckerman; Ashland, July 9, 1879, herb. Morong. CONNECTICUT: Quinnipiac R. at Old Turnpike,

Southington, Aug. 17, 1900 and Aug. 17, 1901, *C. H. Bissell*; Housatonic R., near Lake Zoar, Southbury, *E. H. Eames* 11745. NEW YORK: Saranac R., Adirondacks, July 31, 1884, *Morong*; French Creek, Clayton, Jefferson Co., *Muenschner & Maguire* 1693; Hudson R., below Glen Falls, Warren Co., *Muenschner & Lindsey* 2769; Song L., Cortland Co., *Muenschner & Curtis* 4841; Buffalo, Clinton 5. NEW JERSEY: Delaware R., Hunterdon Co., Sept. 19, 1885, *T. C. Porter*; Lake Hopatcong, *C. F. Austin* (C, mixed with *P. gramineus* var. *typicus*). PENNSYLVANIA: Penn's Creek at "Swinging Bridge," Selinsgrove, Snyder Co., *Moldenke* 4207. ONTARIO: Dog R., above Michipicoten, *John Macoun* 97; Ottawa R., Rockliffe, *John Macoun* 85536; Ottawa R., *Harrington* 99086 & 99102; Templeton, *Scott* 16444. MICHIGAN: St. Clair R., near Port Huron, *Dodge* 155; Sault R., near Sault Sainte Marie, Aug. 11, 1910, *J. R. Churchill* (not typical). OHIO: Sandusky Bay, Aug. 19 and Aug. 31, 1898, *A. J. Pieters* (not typical, perhaps *P. gramineus* × *P. illinoensis*). WISCONSIN: Wisconsin R., near Lac Vieux Desert, *Cheney* 683; Green Bay near Big Suamico shore, Brown Co., July 11, 1886, *J. H. Schuette* (not typical, perhaps *P. gramineus* × *P. illinoensis*). MINNESOTA: Vermilion L., July 28, 1886, *L. H. Bailey*, also *Arthur, Bailey & Holway* B46, B69 & B403; Garden Island, Lake of the Woods, *MacMillan & Sheldon* 1332; near mouth of Brule R., Cook Co., *Rosendahl & Butters* 4638. IOWA: Armstrong, Emmet Co., July 11 and Aug. 21, 1897, *R. I. Cratty*. NORTH DAKOTA: Leeds, Benson Co., July 2, 1906, *J. Lunell*. MACKENZIE: Edna Travers Bay, Great Bear L., Aug. 8, 1928, *A. E. & R. T. Porsild*. SASKATCHEWAN: along Grand Trunk Pacific R. R., Yorkton, *Macoun & Herriot* 76869. ALBERTA: Murdock Creek Dist., Wood Buffalo Park, *Raup* 1546; L. Mamawi, Wood Buffalo Park, *Raup* 1548. MONTANA: Midvale, *Umbach* 457. IDAHO: Moose Creek, near Big Springs, Fremont Co., *G. B. & R. P. Rossbach* 20. WYOMING: Obsidian Creek, Yellowstone Nat'l Park, *Aven & Elias Nelson* 6061. COLORADO: Trout L., near Lizard Head Pass, San Miguel Co., *Maguire, Piranian & Richards* 12771. UTAH: Salt Lake City, *M. E. Jones* 1304; Dry L., Cache Co., *Maguire* 13149. NEW MEXICO: Chusca Mts., San Juan Co., *Wetmore* 549. ARIZONA: Crater L., San Francisco Mts., Aug. 1886, *Lemmon Herbarium*. CALIFORNIA: Lily L., near Fallen Leaf, Lake Tahoe region, Eldorado Co., *Wiggins* 6775. WASHINGTON: Tumwater Canyon, Wenatchee R., *Sandberg & Leiberger* 524; Camas Land, Wenatchee Mts., Chelan Co., *Thompson* 11768. BRITISH COLUMBIA: Shawnigan L., Vancouver Island, *John Macoun* 88253. ALASKA: Sitka, *Evans* 780; Selawik L., *L. J. Palmer* 638 (US, mixed with *P. Richardsonii*).

9c. *P. GRAMINEUS* L. var. *MYRIOPHYLLUS* Robbins

Var. *myriophyllus* Robbins in A. Gray, Man. ed. 5: 487 (1867). *P. heterophyllus* forma *myriophyllus* Morong, Mem. Torr. Club 3: no. 2: 24 (1893). *P. heterophyllus* forma *minimus* Morong, Mem. Torr. Club 3: no. 2: 25 (1893). *P. gramineus* var. *myriophyllus* Graebn. in Engler, Pflanzenr. 4: fam. 11: 87 (1907); Hagstr., Crit. Res. Pot. 209 (1916). *P. gramineus* var. *minimus* Graebn. in Engler, Pflanzenr. 4: fam. 11: 89 (1907). *P. heterophyllus* Taylor, N. Am. Fl. 17: pt. 1: 19 (1909), in part. *P. gramineus* forma *myriophyllus* House, N. Y. State Mus. Bull. 254: 53 (1924).

Quiet water, local in New Hampshire, Massachusetts, Rhode Island, New York, Michigan, Indiana, Wisconsin, Minnesota, and Montana. MAP 12. Although many collections approach this variety, only the following are considered typical: NEW HAMPSHIRE: Lake Winnepesaukee, 1876, *W. F. Flint*. MASSACHUSETTS: Spot P., Stoneham, Aug. 20, 1865, herb. *Wm. Booth*, also July 27, 1876, *Morong*, also Aug. 13, 1880, herb. *E. & C. E. Faxon*; Spot P., Wyoming, Aug. 13, 1880, herb. *C. E. Faxon*; Spot P., Melrose, Aug. 13, 1880, *Edwin Faxon*; Winter P., Winchester, Middlesex Co., *Fernald & Svenson* 744; Wakefield, Sept. 13, 1876, *J. W. Chickering*; Lake Pataquatic, Ware, Aug. 25, 1905, *E. L. Morris*. RHODE ISLAND: Apponaug P., Apponaug, Oct. 14, 1865, Robbins (TYPE in NY), also Aug. 1879, Sept. 29, 1879 and Aug. 26, 1880, *Morong*, also Aug. 26, 1880, *E. Faxon*, also Aug. 26, 1880 herb. *E. & C. E. Faxon* ("Kingston" appears on the labels, which is an error, for the collection was made at Apponaug in the town of Warwick), also Aug. 24, 1881, *E. Faxon*, also Aug. 25, 1881, *Morong*; Gorton's P. (Apponaug P. of early botanical collectors), Apponaug, town of Warwick, *E. C. & E. B. Ogden* 1765. NEW YORK: Mud P., Pattens Mills, Warren Co., Aug. 25, 1918, *S. H. Burnham*; Friends L., Warren Co., *Muenschler & Lindsey* 2775. MICHIGAN: Sister Lakes, Van Buren Co., *De Selm* 22. INDIANA: Dune Park, *Peattie* 2305. WISCONSIN: Oneida Reservation, Sept. 8, 1881, *J. H. Schuette*; Devils L., Sauk Co., *Fassett* 14262. MINNESOTA: Lake Mora, Kanabec Co., July 1892, *E. P. Sheldon*; Milaca, Mille Lacs Co., July 1892, *E. P. Sheldon*. MONTANA: Bitterroot R., s. w. of Missoula, Missoula Co., *Barkley* 1996.

The extremely variable *P. gramineus* which often approaches in appearance its near relative, *P. illinoensis*, is further complicated by the fact that it hybridizes with most (perhaps all) of the other broad-leaved species of the genus and even one (perhaps more) linear-leaved species. In North America three varieties can be recognized which, though distinct in their extreme de-

velopments, intergrade freely. The variety that appears to be identical with the one upon which the species is based (var. *typicus*) is by far the most common, and is rather widespread in both Europe and North America. Its much branched stem has usually an abundance of small elliptic-lanceolate submersed leaves which distinguish it from all other species of *Potamogeton* as well as from the other varieties of the same species.

The variety *myriophyllus* has a stem even more branched and the leaves still smaller but with parallel margins. This would seem to be but an ecological form were it not found in somewhat different habitats, according to data on labels. When I collected it in Apponaug Pond in 1938 it was exactly like the plants Robbins collected there in 1865.

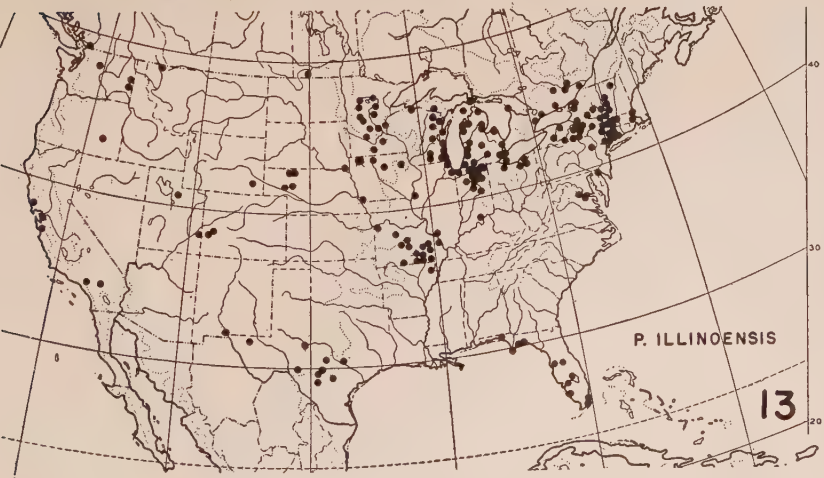
The variety *maximus* is perhaps the most variable one. It differs from the other variants of the species in the larger size of the submersed leaves, less branching of the stem, and usually longer internodes. While for most collections this variety seems to be genetic, for many the condition appears to be ecological. It is oftentimes very difficult to distinguish it from hybrids having *P. gramineus* for one of the parents. It can usually be distinguished from *P. gramineus* \times *P. illinoensis*, which appears most like it, by the more flaccid stem and leaves of the variety.

Plants appearing like typical *P. gramineus* or var. *maximus*, except that the submersed leaves are oblanceolate or spatulate, with the apex rounded, mucronate, or cuspidate (often with many variations on the same plant) occur. These have been called *P. gramineus* var. *spathulaeformis*. The type material upon which this name is based is from the Mystic Lakes, Medford, Mass. and proves to be *P. gramineus* \times *P. illinoensis*. Plants with submersed leaves somewhat similar but usually smaller and with floating leaves usually orbicular or very short-elliptic occur in Newfoundland, Quebec, New Brunswick, Vermont, New York, Ontario, Michigan, Minnesota and Iowa. While the usual stem-anatomy pattern is that of *P. gramineus*, occasionally O-cells are found in the endodermis, thus pointing toward a parent (or grandparent) with an endodermis of O-cells. The broad rounded apex of the submersed leaves and the nearly orbicular floating leaves point to an ancestor with broad rounded leaves. Some of these plants are *P. gramineus* \times *P. perfoliatus*,

others are *P. gramineus* \times *P. Richardsonii*, in both cases probably backcrossed with *P. gramineus*. At Moran, Mackinac Co., Michigan, in the shallow water at the northwest end of Brevort Lake, I found typical *P. gramineus* (Ogden & Bolan 1680) and obvious *P. gramineus* \times *P. Richardsonii* (Ogden & Bolan 1681, with *Richardsonii*-like submersed leaves and *gramineus*-like floating leaves) and clearly intermediate between the two a plant with oblanceolate submersed leaves (Ogden & Bolan 1681 in Gray Herbarium). See discussion of these hybrids on later pages. Not all oblanceolate-leaved plants are hybrids, however, for leaves of the typical variety or of the variety *maximus* which have been produced at the surface of the water may tend to form a transition to the floating type, which may narrow the lower half and produce a mucro at the apex; in such cases the lower leaves, if submersed, will have the normal shape. Then, too, submersed leaves often have a tendency for the edges of the lower part to curl under, giving the leaf a false oblanceolate shape which close examination will detect.

10. *P. ILLINOENSIS* Morong

RHIZOME buff, spotted, streaked, or suffused with red, as thick as or thicker than the stem. **STEM** simple or branched, terete, but sometimes much flattened when pressed, (1-) 1.5-5 mm. in diameter; stele with the proto-type, trio-type, or oblong-type pattern with (1) 2 central bundles and 2 or more lateral bundles on each side; endodermis of strongly developed U-cells; interlacunar bundles strongly developed in the outer interlacunar circle, sometimes a few in the next to the outer circle; subepidermal bundles present or absent; pseudo-hypodermis absent or 1 cell thick. **SUBMERSED LEAVES** thin, elliptic or oblong-elliptic (sometimes ovate-elliptic) to lanceolate or linear (by the further reduction of the blade to the midrib), often somewhat arcuate; blades 5-20 cm. long, (.2-) 1.5-4 (-4.5) cm. wide, sessile or tapering (except when reduced to midrib) into petioles up to 4 cm. long; apices acute, usually somewhat mucronate; nerves (7-) 9-17 (-19); lacunae of 2-5 rows along midrib and larger nerves; margin with fugacious 1-celled translucent denticles. **FLOATING LEAVES** (often absent) more or less coriaceous, transition to submersed leaves usually gradual; blades elliptic, ovate-elliptic, or oblong-elliptic, 4-13 (-19) cm. long, 2-6.5 cm. wide; apices obtuse, ending in a blunt mucro; bases cuneate or rounded; petioles 2-9 cm. long, shorter than the blade; nerves 13-29; lacunae of 2 or 3 rows of cells along midrib, some-



RANGES OF POTAMOGETON

times obscure. STIPULES persistent, divergent and conspicuous, obtuse, those of the submersed leaves (1-) 2.5-8 cm. long, (.3-) .5-1.2 cm. wide at base, prominently 2-keeled, with 15-35 finer nerves; those of the floating leaves broader. PEDUNCLES as thick as or thicker than the stem, 4-15 (-30) cm. long. SPIKES in anthesis more or less compact, of 8-15 whorls of flowers; in fruit cylindric and crowded (2.5-) 3-6 (-7) cm. long, .8-1 cm. thick. FLOWERS sessile or on pedicels up to .5 mm. long; sepaloid connectives orbicular to oval (or reniform), blades (1.3-) 1.6-3 (-3.2) mm. wide, claws 1-1.5 mm. long; anthers oblong, .6-2 mm. long. FRUITS obovate to orbicular or ovate (2.5-) 2.7-3.5 (-3.6) mm. long (excluding beak), (2.1-) 2.2-3 mm. wide; sides flat; keels prominent and acute, the dorsal strongly developed above and below, the laterals less strongly developed but often each with a projecting knob at the base; beak facial, short, erect or curved toward the back; exocarp gray-green to olive-green (rarely brownish); endocarp with keels low but prominent, or with dorsal keel thin and very weak, beak deltoid, very weak, about .5 mm. long, loop solid; apex of seed pointing at about the middle of the opposite side (or between middle and base). A highly variable species in which the extremes appear distinct, but transitional specimens, which are not the exception but the rule, indicate that they are a confluent series.

P. illinoensis Morong, Bot. Gaz. 5: 50 (1880); Mem. Torr. Club 3: no. 2: 27 (1893); Graebn. in Engler, Pflanzenr. 4: fam. 11: 80 (1907); Taylor, N. Am. Fl. 17: pt. 1: 20 (1909); Hagstr., Crit. Res. Pot. 198 (1916). *P. lucens* of Am. authors; not L., Sp. Pl. 126 (1753). *P. Zizii* of Am. authors, in part; not M. & K. in Röhl. Deutschl. Fl. 1: 845 (1823); not Koch ex Roth, Enum. Plant. Germ. 1: 531 (1827). *P. Proteus lucens* C. & S., Linnaea 2: 197 (1827). *P. Proteus Zizii* C. & S., Linnaea 2: 201 (1827), in part. *P. lucens* var. *connecticutensis* Robbins in A. Gray, Man. ed. 5: 488 (1867); Morong, Mem. Torr. Club 3: no. 2: 31 (1893). *P. angustifolius* var. *connecticutensis* Bennett, Journ. Bot. 39: 199 (1901). *P. Zizii* var. *connecticutensis* Morong ex Bennett, Journ. Bot. 39: 199 (1901); Graebn. in Engler, Pflanzenr. 4: fam. 11: 83 (1907). *P. lucens* var. *floridanus* Bennett in Graebn. in Engler, Pflanzenr. 4: fam. 11: 79 & 161 (1907); Bennett, Journ. Bot. 45: 374 (1907). ?*P. Zizii* var. *porrectifolius* Bennett in Graebn. in Engler, Pflanzenr. 4: fam. 11: 83 (1907). ?*P. Zizii* var. *gracilis* Bennett in Graebn. Pflanzenr. l. c. (1907). *Spirillus lucens* Nieuwland, Am. Mid. Nat. 3: 17 (1913), as to plant, not as to source of name. *Spirillus Zizii* Nieuwland, Am. Mid. Nat. 3: 17 (1913), in part. *P. illinoensis* forma *rosulatus* Hagstr., Crit. Res. Pot. 199 (1916). *P. illinoensis* forma *homophyllus* Hagstr., Crit. Res. Pot. 199 (1916). × *P. pseudolucens* Hagstr., Crit. Res. Pot. 199 (1916).

? \times *P. perplexus* Benn., Trans. & Proc. Bot. Soc. Edinburgh **29**: 53 (1924).

Lakes and streams, southwestern Quebec to southern British Columbia, south to Florida, Texas and California, MAP 13. Mex., Centr. Am., and W. I. Of the very numerous collections, the following are the most typical from the areas cited: QUEBEC: Gatineau R., Wakefield, *Macoun* 62021. VERMONT: Lake Dunmore, Salisbury, Aug. 11 and 31, 1896 and Sept. 2, 1899, *Ezra Brainerd*; Lake Champlain, Sept. 1, 1880, *C. E. Faxon*; Lake Horton, Aug. 15, 1896, *Ezra Brainerd*; Barton P., 1829, herb. *Robbins*. MASSACHUSETTS: Fresh P., Cambridge, many collectors; Wenham P., Essex Co., Sept. 21, 1867, *J. W. Robbins*; Leverett P., July 1874, *H. G. Jesup*. CONNECTICUT: Lake Saltonstall, E. Haven, 1845, *Robbins*, also 1850, *Robbins* (G, NY, type collection of *P. lucens* v. *connecticutensis*); Lake Kenosha, Danbury, *E. H. Eames* 11351; Housatonic R., Aug. 1867, *Robbins*; Twin Lakes, Salisbury, Litchfield Co., *Ogden & Bolan* 1569. NEW YORK: Rockland L., July 17, 1892, *Morong*; Lake Cayuga, Cayuga, Aug. 20, 1884, *Morong*; Duck L., Conquest, Cayuga Co., *Eames, Randolph & Wiegand* 11175; bayou back of Renwick Park, Cayuga L., Ithaca, Tompkins Co., *Hitchcock* 11175a; n. of R. R. bridge, Cayuga, Cayuga Co., Oct. 1886, *W. R. Dudley*; Lake Oneida, July 28, 1880, *Miss M. T. Hotchkiss*; Lake Cossayuna, *Dobbin* 1112; Muskalonge Bay, Jefferson Co., *Muenschner & Maguire* 1701; Ballston L., Saratoga Co., *Muenschner & Clausen* 4232 & 4233; Warner L., Albany Co., *Muenschner & Clausen* 4238; Little York L., Preble, Cortland Co., *R. N. Jones* 7465; Greens L., Greene Co., *Muenschner & Curtis* 5427. PENNSYLVANIA: Lehigh, 1876, *E. A. Rau* (ME, "Hanover, Ind." printed on the label). DELAWARE: Stanton, Sept. 4, 1896, *A. Commons*. VIRGINIA: Four Mile Run, Alexandria, June 29, 1903, *I. Tidestrom*; Dyke, Fairfax Co., *Metcalf & Sperry* 1690. NORTH CAROLINA: Orton L., Orton Plantation, 10 mi. n. of Southport, Brunswick Co., Sept. 8, 1941, *R. K. Godfrey* (G). FLORIDA: near the south New R. canal, beyond head of New R., *J. K. & G. K. Small* 4437; near the Miami canal, *J. K. & G. K. Small* 4486; between Cutler and Longview Camp, *Small & Carter* 1007; Royal Palm Park, Dade Co., *Moldenke* 752; near Eustis, Lake Co., Oklawaha R., *Nash* 859 & 1750, also *Curtiss* 6692; Caloosa R., *Simpson* 386; Everglades, Miami R., *Small & Carter* 1118 (F, NY, US, type collection of *P. lucens* v. *floridanus*). ONTARIO: Golden L., Renfrew Co., July 28, 1899, *L. M. Umbach*; Pelee Island, Lake Erie, *Macoun* 3023; River Trent, *Macoun* 2995; Elziver, Hastings Co., *Macoun* 2996; Stokes Bay, Tobermory, Bruce Co., *Krotkov* 7027. MICHIGAN: Whitefish L., Mackinac Co., *Metcalf* 2317; n. w. of St. Ignace, Mackinac Co., *Pease & Ogden* 24964; Lake Orion, *Farwell* 900; Houghton L.,

Roscommon Co., June 1876, herb. *C. F. Wheeler*; Swan L., Allegan Co., *Wight* 8; Papaw L., Berrien Co., *C. K. Dodge* 171; Pine L., Clinton Co., *C. F. Wheeler* 11 & 24. OHIO: East Harbor, Ottawa Co., Aug. 10, 1898, *E. L. Moseley*; Bass L., Geauga Co., *Werner* 954; Sandusky Bay, Aug. 31, 1898, *A. J. Pieters*. INDIANA: Old L., Whitley Co., *Deam* 49428; Tippecanoe L., *Scovell* 53; Lake Maxinkuckee, *Scovell* 54, also *Evermann* 1079 & 1222, also *Clark* 6; Lake Maxinkuckee, Culver, Marshall Co., Aug. 27, 1926, *J. R. Churchill*; Pine Station, Lake Co., Aug. 8, 1876, *E. J. Hill*; Clarke, *Umbach*, also *Lansing* 1079; Atwood L., n. w. of Wolcottville, Lagrange Co., *Deam* 55350; Lake Wawasee, Kosciusko Co., *Deam* 56396 & 56401; Lake James, w. of Pokagon State Park, Steuben Co., *Deam* 56538 & 56539. WISCONSIN: Lake Wingra, Dane Co., June 20, 1892, *L. S. Cheney*; White L., near Weyauwega, Waupaca Co., *Hotchkiss* & *Martin* 4432; Pickerel L., Nashville Twp., Forest Co., *Hotchkiss* & *Koehler* 4331; Big Muskego L., Muskego Twp., Waukesha Co., *Hotchkiss* & *Koehler* 4245; Wind L., Norway Twp., Racine Co., *Hotchkiss* & *Koehler* 4226 & 4227; Pike L., Hartford Twp., Washington Co., *Hotchkiss* & *Koehler* 4262; Shawano L., Washington Twp., Shawano Co., *Hotchkiss* & *Koehler* 4304; Lake Noque Bay, Lake Twp., Marinette Co., *Hotchkiss* & *Koehler* 4326. ILLINOIS: Mississippi River Bottoms near Oquawka, July 23, 1873, Aug. and Sept. 1881, *H. N. Patterson* (TYPE material); Pittsburg L., Centerville, June 29, 1878, *H. Eggert*; Lake Villa, Sept. 28, 1887, *M. B. Waite*. MANITOBA: Souris, July 7, 1883, *J. M. Macoun*. MINNESOTA: Elk L., Itaska Park, Clearwater Co., *Grant* & *Oosting* 3184; Evans L., Kandiyohi Co., *Metcalf* 2377; Green L., Kandiyohi Co., *Metcalf* 2039, 2048 & 2045; Lake Lizzie, Ottertail Co., *Metcalf* 1563; Rice L., Paynesville, *Metcalf* 1427 & 1432; Koronis L., Stearns Co., *Metcalf* 1379, 1383 & 1391, also *Kubichek* 110, 114, 115 & 121; Swan L., Nicollet Co., *Metcalf* 8; Martin L., Anoka Co., *Metcalf* 1329; Birch L., Sherburne Co., *Metcalf* 1370; Horseshoe L., Chisago Co., *Kubichek* 71 & 72; Prior L., Scott Co., *Oosting* 2938; Lake Ida, Douglas Co., *Uhler* & *Warren* 858; Lake Julia, Sherburne Co., *Keck* & *Stevens* 280; Borden L., Garrison Twp., Crow Wing Co., *Hotchkiss* & *Jones* 4113; Center City, Aug. 1892, *B. C. Taylor*; Two Inlet L., Becker Co., *Shunk* & *Manning* 237. IOWA: Armstrong's Grove, Emmet Co., July 21, 1882, *R. I. Cratty* (cotype collection of *P. illinoensis*); Fayette, July 1894, *B. Fink* 191; Fremont Co., Aug. 2, 1898, herb. *T. J. & M. F. L. Fitzpatrick*; Clear L., Cerro Gordo Co., July 11, 1896, *B. Shimek*. MISSOURI: Fish L., Sibley, Jackson Co., *Mackenzie* 293; Gasconade R., between Falcon and Nebo, Laclede Co., *Steyermark* 13910; Current R., n. of Buffalo Creek, e. of Bennett, Ripley Co., *Steyermark* 14285; Phillips Spring, s. e. of Van Buren, Carter Co., *Steyermark* 21235;

Marble Creek, s. of French Mills, St. Francois Purchase Unit, Clark Nat. Forest, Madison Co., *Steyermark* 21087. ARKANSAS: St. Francis R., Paragould, Greene Co., June 27, 1893, *H. Eggert*. SOUTH DAKOTA: water hole near Missouri R., Clay Co., *Over* 4008. NEBRASKA: Rat L., *Thomson* 53; Swan L., s. of Whitman, Grant Co., *Rydberg* 1440; Shafer L., Garden Co., *Uhler & Martin* 1662; Hackberry L., Cherry Co., *Thomson* 145, also *Sharp* 11; Dewey L., Cherry Co., *Tolstead* 614. TEXAS: Guadalupe R., Kerrville, Kerr Co., *E. J. Palmer* 12217; 16 mi. n. of Leakey, Real Co., *Cory* 8502; San Antonio, *Thurber* 48; Montell Creek, Uvalde, *Cory* 9800; McKittrick Canyon, Guadalupe Mts., Culberson Co., *Moore & Steyermark* 3667 (not typical). WYOMING: Laramie R., *Elias Nelson* 3386. COLORADO: Tabeguache Basin, *Payson* 174; Cerro Summit, region of Gunnison Watershed, *Baker* 427. UTAH: Twelve Mile Cañon, Wasatch Mts., *Tides-trom* 517. NEW MEXICO: San Augustine Ranch, Organ Mts., Dona Ana Co., July 10, 1909, *E. O. Wooton*. CALIFORNIA: Marine Hospital, San Francisco, June 27, 1892, *J. W. Blankinship*; Mission Dolores, *Bolander* 274; near Sebastopol, Sonoma Co., Aug. 1900, *M. S. Baker*; Mountain L., San Francisco, Aug. 22, 1920, *Alice Eastwood* (not typical). OREGON: creeks, western Oregon, 1880, *T. J. Howell*; in a warm spring, Harney Valley, June 10, 1885, *Thomas Howell* (F, mixed with *P. alpinus* v. *tenuifolius*, C, G, US, not mixed). WASHINGTON: Lake Chelan, Washington Forest Reserve, *Gorman* 703; Turnbull Slough, Spokane Co., *Sperry & Martin* 731. BRITISH COLUMBIA: Sumas L., Chilliwack Valley, *J. M. Macoun* 26815 (perhaps a hybrid; type of \times *P. perplexus* in C, isotypes in G, NY).

The highly complex species, *P. illinoensis*, has been variously treated by students of the genus. Morong¹ restricted the name to two collections of those known to him: Oquawka, Ill., collected by H. N. Patterson, and Armstrong's Grove, Iowa, collected by R. I. Cratty. Both plants are very robust and evidently grew in shallow, quiet, rich, muddy water. He complained that some botanists doubted the validity of *P. illinoensis* as a distinct species, but argued that it ". . . is evidently allied to *lucens* in habit, and with that species, *P. angustifolius*, *P. spathulaeformis* and *P. heterophyllus*, forms a very natural group, but it is clearly distinct from all of them in its vigorous growth, its abundant foliage, its ample floating and submerged leaves, and its large, strongly 3-keeled fruit."² Of these characters, the only one that can be considered of specific importance is that per-

¹ Thomas Morong, Mem. Torr. Club, 3: no. 2: 27 (1893).

² Thomas Morong, Mem. Torr. Club 3: no. 2: 28 (1893).

taining to the fruit, and examination shows that the fruits of the plants in this country called *P. lucens* or *P. angustifolius* are as strongly 3-keeled as those of *P. illinoensis*. Graebner's treatment of this group is quite artificial. He followed Morong's grouping rather closely but recognized numerous subspecies, varieties, subvarieties, and forms to account for the minor divergencies. The name *P. illinoensis* was, however, confined to the two original collections. Hagström evidently made a genuine attempt to understand the complex. Lack of sufficient material greatly handicapped him. He was misled by previous treatments into believing that *P. lucens* occurs in this country, but cited no specimens. Morong, who had realized that the plants he referred to *P. lucens* did not match any of the European forms of that species, treated them as var. *connecticutensis*. Hagström ignored this, except to question its being a variety of *P. lucens*, and does not even include it as a synonym. Some sterile specimens in North America resemble *P. lucens* of Europe but they lack the tendency for the lower leaves to have the blades reduced at the apex so that the midrib extends well beyond as a cusp. When mature fruits are obtained, the keels are seen to be prominent and acute (those of *P. lucens* are low and rounded) and the beak is more facial. Interestingly enough, specimens with mature fruit do not have the compact, bushy habit of *P. lucens* and would not be confused with that species.

Hagström considered *P. angustifolius* (*P. Zizii*) to be the hybrid *P. gramineus* \times *lucens*, a belief held or suspected by many students of the genus. He cites specimens from North America but calls attention to the fact that ". . . many *Zizii*-like North American plants are not at all this hybrid, but of another origin, and great carefulness is necessary when considering these difficult forms."¹ If *P. lucens* does not occur in this country, the hybrid *P. gramineus* \times *lucens* must be absent also. It may be suspected that the hybrid *P. gramineus* \times *illinoensis* is not uncommon with us for it is known that each of these closely related species hybridizes with species of other subsections. Many intermediate forms occur, but it is usually difficult to determine which are the results of crossing and which are ecological variants of one or the other species.² The plants of the subsection *Lucentes*

¹ J. O. Hagström, Crit. Res. Pot. 216 (1916).

² See discussion under HYBRIDISM.

fruit as freely as the average species of *Potamogeton*, and I think that nearly all of them must be considered to belong to one or the other of the two species.

The earliest specific name for the large-leaved plant is *P. illinoensis* Morong. This species has several variants, the recognition of which is made difficult in that ecological forms of one may simulate normal states of another. The *Lucentes* need to be studied cytologically and, until the hybrids having *P. illinoensis* as a parent are better understood, a grouping of the variants into varieties would be merely an artificial one. In order not to delay this treatment further, *P. illinoensis* is treated in the broad sense, including its many variations.

11. *P. PRAELONGUS* Wulfen

RHIZOME whitish, suffused or spotted with rusty red, as thick as the stem or often much thicker. **STEM** simple or branched, whitish or olive-green, often zigzag, 1.5–4 mm. in diameter; stele with the proto-type pattern; endodermis of U-cells; inter-lacunar and subepidermal bundles present; pseudo-hypodermis 1–3 cells thick. **LEAVES** all submersed, ovate-oblong, (5–) 10–20 (–36) cm. long, 1–3 cm. wide, 13–25 nerves, 3–7 of them more prominent than the others, cordate or rounded at base and clasping $\frac{1}{3}$ or $\frac{1}{2}$ the circumference of the stem; apex cucullate, splitting when pressed, or rounded; margin entire; lacunae of 2–4 rows of cells each side of the midrib. **STIPULES** white, nerves moderately strong, oblong to oblong-linear or ovate-lanceolate, rounded at apex, (3–) 5–10 cm. long, without keels, usually persistent and conspicuous. **PEDUNCLES** variable in thickness, clavate, (5–) 15–60 cm. long. **SPIKES** with 6–12 whorls, not crowded at anthesis, sometimes moniliform; in fruit 3–5 cm. long, 1.1–1.4 cm. thick. **FLOWERS** sessile or on pedicels up to .5 mm. long; sepaloid connectives greenish, blades orbicular or elliptical, (1.7–) 2–2.6 (–2.9) mm. wide, claws 1–2 mm. long; anthers 1–2 mm. long. **FRUITS** obovate, rounded on the back, cuneate at base, (4–) 4.3–5 mm. long (excluding beak), 3.2–4 mm. wide; beak prominent, short and thick; dorsal keel acute and strongly developed, especially upward; lateral keels rounded or none; exocarp dark green; endocarp with rounded lateral keels and a dorsal keel which is alate, thin and weak, beak linear, facial, about .8 mm. long, loop with a linear cavity; apex of seed pointing toward the basal end or slightly above. Plants characterized by large ovate-oblong leaves, cucullate at the tip, whitish stem, large conspicuous stipules, and with long peduncles bearing large fruits.

P. praelongus Wulf., Arch. Bot. Roem. **3**: 331 (1805); Benn., Journ. Bot. **19**: 241 (1881); Morong, Mem. Torr. Club **3**: no. 2: 32 (1893); Graebn. in Engler, Pflanzenr. **4**: fam. 11: 96 (1907); Taylor, N. Am. Fl. **17**: pt. 1: 22 (1909); Hagstr., Crit. Res. Pot. 250 (1916). *Spirillus praelongus* Nieuwl., Am. Midl. Nat. **3**: 17 (1913).

Deep, cold water, southern Labrador, Newfoundland, Gaspé Peninsula, Prince Edward Island, New England, and New Jersey, west to California, and north to Alberta, Mackenzie and the Aleutian Islands. MAP 14. Eurasia. Reported from Mexico. The following, from a large series of specimens, are representative: LABRADOR: Trout P., Blanc Sablon R., Straits of Belle Isle (also on the Quebec side of the river), *Fernald & Long* 27347. NEWFOUNDLAND: Cook Point, Pistolet Bay, *Fernald, Gilbert & Hotchkiss* 27346; Tilt Cove, northern shores of Notre Dame Bay, *Fernald, Wiegand & Darlington* 4482; Birchy Cove (Curling), Region of Humber Arm, Bay of Islands, *Fernald, Wiegand & Kittredge* 2441; Middle Birchy P., eastern drainage area of the Humber R. system, *Fernald & Wiegand* 2444 (C, G, flaccid form); Morley's P., Humber Arm, Bay of Islands, *Fernald, Long & Fogg* 1211; Junction P., Whitbourne, Avalon Peninsula, *Fernald, Long & Dunbar* 26223. QUEBEC: Lac Pleureuse, Gaspé Co., *Fernald, Dodge & Smith* 25423 & 25424; West Branch of Mont Louis R., Gaspé Co., *Fernald, Dodge & Smith* 25422; Lac Sainte-Anne, Gaspé Co., *Victorin, Rolland & Jacques* 33518; New-Richmond, Bonaventure Co., *Victorin, Rolland & Jacques* 33838; Lac Porc-Épic, Saint-Fabien, Rimouski Co., *Rousseau* 30004. PRINCE EDWARD ISLAND: Dundee, Kings Co., *Fernald, Long & St. John* 6767; French River, Queens Co., *Fernald, Long & St. John* 6768. NEW BRUNSWICK: Woodstock, Aug. 1884, *Geo. U. Hay* 4131. NOVA SCOTIA: Earltown Lakes, Aug. 10, 1883, *McKay* 4129. MAINE: Houlton, Aroostook Co., 1881, *Furbish*; 5th Lake Musquacook, Piscataquis Co., *G. B. Rossbach* 82; St. John P., Somerset Co., *St. John & Nichols* 2107; Pushaw L., Orono, Penobscot Co., Aug. 1891, *Furbish*; Hammond P., Hampden, Penobscot Co., *Ogden & Steinmetz* 1604; Hermon P., Hermon, Penobscot Co., *Ogden, Babel & Kozicky* 1880 (flaccid form); Pleasant P., Stetson, Penobscot Co., *E. C. & E. B. Ogden & F. H. Steinmetz* 1882, *Gray Exsic. no. 1105*; Androscoggin R., Livermore Falls, Androscoggin Co., 1894, *Furbish*; Torsey P., Kent's Hill, Readfield, Kennebec Co., 1892, *Furbish*. NEW HAMPSHIRE: Ladd P., Stewartstown, *Pease* 14012; Streeter's P., Lisbon, June 18, 1887, ex herb. *E. & C. E. Faxon*; Round P., Connecticut Lakes, *Kendall, Gouldsborough & Doolittle* 17. VERMONT: Shelburne P., June 28, 1878, *Pringle*; Harvey's P., West Barnet, Sept. 7, 1885, *F. Blanchard*; Willoughby, Orleans Co., Aug. 31, 1904, *A. Lorenz*. MASSACHUSETTS: Chadwick's P., Essex Co.,

S. K. Harris 539; Pleasant L., Hamilton, Essex Co., *Fernald & Svenson* 749; Fresh P., Cambridge, Middlesex Co., *many collectors*; Harmon P., New Marlboro, Berkshire Co., June 29, 1912, *R. Hoffmann*; Stockbridge Bowl, Stockbridge, Berkshire Co., Aug. 9, 1914, *R. Hoffmann*. CONNECTICUT: Bantam L., Litchfield, Litchfield Co., July 25, 1883, *Morong*; Lake Saltonstall, Sept. 23, 1880, *E. & C. E. Faxon*; Twin Lakes, North Branford, New Haven Co., June 22, 1887, *E. B. Harger*; Twin Lakes, Salisbury, Litchfield Co., *Eames & Godfrey* 8685. NEW YORK: Southeast Bay, Saratoga L., Saratoga Co., *Muenschler & Lindsey* 2819; Dexter L., St. Lawrence Co., *Muenschler & Maguire* 829; Lake Placid, Essex Co., *Muenschler, Manning & Maguire* 141; Cayuga L., Tompkins Co., July 29, 1884, *Dudley*; Pierrepont P., inlet from Lake Ontario, Woodville, Jefferson Co., *House* 10070; Ballston L., Saratoga Co., *Muenschler & Clausen* 4205. NEW JERSEY: Swartswood L., Sussex Co., *Griscom & Mackenzie* 10681. ONTARIO: Lake Hannah, Nipigon R., July 21, 1884, *John Macoun*; Lake Scugog, *Wm. Scott* 16451, also *Cain* 972; Inner Long Point Bay, Lake Erie, *Cain* 1050; Almonte, July 6, 1898, *J. Fowler*. MICHIGAN: Isle Royale, *Cooper* 312; Lake Manganese, Copper Harbor, Keweenaw Co., *Hermann* 8234; Tahquamenon R., Luce Co., *Metcalf* 2291; Douglas L., Cheboygan Co., *Ehlers* 533 & 1756, also June, July 1924, *J. R. Swallen*; Fremont L., Newago Co., July 7, 1926, *Oosting*; Crystal L., Montcalm Co., *C. F. Wheeler* 273; Pine L., vicinity of Agr'l Coll., *C. F. Wheeler* 10; Haslet, *Yunker* 713; Vicksburg, Kalamazoo Co., July 5, 1937, *F. W. Rapp*; Clear L., Jackson Co., *Hermann* 6281. OHIO: Put-in-Bay, July 16, 1898, *A. J. Pieters*. INDIANA: Bear L., Noble Co., *Deam* 49394; Wolf L., *Agnes Chase* 1466; Lake Maxinkuckee, *Scovell* 45 & 66; near Lake Maxinkuckee, *Scovell & Clark* 1321. WISCONSIN: Green Bay, 1892, *Schuetz*; Twin Lakes, Marquette Co., *Uhler & Warren* 1079; Big Muskego L., Muskego Twp., Waukesha Co., *Hotchkiss & Koehler* 4246; Wind L., Norway Twp., Racine Co., *Hotchkiss & Koehler* 4228; Rice L., Nashville Twp., Forest Co., *Hotchkiss & Koehler* 4340; valley of the Wisconsin R., near Lac Vieux Desert, *L. S. Cheney* 499; Lauderdale, *Bebb* 1009. MINNESOTA: Burntside L., July 25, 1886, *L. H. Bailey*; Lake Itasca, Clearwater Co., *Grant* 3029; Swan L., *Hotchkiss & Jones* 3928; Center City, Chisago Co., July 1892, *B. C. Taylor*; Lake Chisago, *Metcalf* 1229; James L., Kandiyohi Co., *Metcalf* 2387; Geneva L., Freeborn Co., *Shunk & Manning* 80; German L., LeSueur Co., *Shunk & Manning* 229; Leaf L., Becker Co., *Shunk & Manning* 368; Christine L., Douglas Co., *Shunk & Manning* 410; Pelican L., Wright Co., *Linsdale & Keck* 153, also *Uhler & Warren* 797½; Child L., Cass Co., *Metcalf* 2371; Lake Johanna, Pope Co., *Keck & Stilwell* 455. IOWA: Clear L., Cerro Gordo Co., July 11, 1896, *B. Shimek*. NORTH

DAKOTA: Roland Twp., Turtle Mts., Bottineau Co., *Metcalf* 522; Pelican L., Turtle Mts., Bottineau Co., *Metcalf* 546. NEBRASKA: Hackberry L., Cherry Co., July 18, 1912, *Pool & Folsom*; Dewey L., near Valentine, *Tolstead* 430; Enders L., *Thomson* 2. MACKENZIE: 2nd Eskimo L., 68° 10' N., 132° 55' W., Aug. 19, 1927, *A. E. & R. T. Porsild*. ALBERTA: Moose Lake district, Wood Buffalo Park, *Raup* 1570 & 1571; Murdock Creek district, Wood Buffalo Park, *Raup* 1572. MONTANA: Lower Two Medicine Lakes, *Maguire* 485; Lower St. Mary's L., *Maguire* 486. IDAHO: Henry L., Fremont Co., *E. B. & L. B. Payson* 2024; Gray's L., *Sperry & Martin* 696. WYOMING: Swastika L., Medicine Bow Mts., Albany Co., *A. & R. A. Nelson* 973, also *R. J. Davis* 378-W; Heart L., Yellowstone Nat'l Park, *Clifford Richardson*. COLORADO: Cottonwood L., *Shear* 3804; vicinity of Twin Lakes, July-Aug. 1902, *C. Juday*; Echo L., s. w. of Idaho Springs, Clear Creek Co., *Ehlers* 7957. UTAH: Panguitch L., *M. E. Jones* 6023, Fish L., Fish Lake Forest, July 23, 1922, *S. B. Locke*; Posey L., 14 mi. n. of Escalante, Garfield Co., Sept. 3, 1936, *Geo. Piranian*. CALIFORNIA: Webber L., Sierra Co., Aug. 1894, *Dudley*; Lassen's Peak, July 1879, *Mrs. R. M. Austin*. OREGON: Wallowa L., *Cusick* 2484; Klamath marsh, Klamath Indian Reservation, *Coville* 1254. WASHINGTON: Wiser L., Whatcom Co., *Muenschner* 7647; Lake Leland, Jefferson Co., *Otis* 1767. BRITISH COLUMBIA: Langford L., Vancouver I., *John Macoun* 4132a & 88257; Beaver L., near Victoria, *John Macoun* 88258 & 88259. ALASKA: Atka, Aleutian Islands, *Eyerdam* 948 & 1122.

P. praelongus is a beautiful species with large bright green oblong leaves, and it often has extremely long peduncles terminated by huge spikes with massive fruit. It can scarcely be mistaken for any other species. Bennett¹ quotes remarks from Morong to the effect that this species fruits very late (Nov. to Dec.). However, specimens in herbaria with fruit are mostly collected in July and August. Robinson and Fernald say, "Fruiting in June and July, withdrawing the stems to deep water to mature the fruit,"² and this seems to be the case. More June collections of this plant are desirable. An extremely flaccid form (*forma elegans* Tiselius) was collected in Newfoundland by Fernald and Wiegand (*Fern. & Wieg.* 2444); one much like it grows in Hermon P., Maine (*Ogden, Babel & Kozicky* 1880).

12. *P. RICHARDSONII* (Bennett) Rydberg

RHIZOME whitish, yellowish or pinkish, not spotted; scales blackish, rounded at apex. STEM often branched, unspotted,

¹ Arthur Bennett, *Journ. Bot.* 19: 241 (1881).

² Robinson & Fernald, *Gray's Man. ed.* 7: 74 (1908).

1–2.5 mm. in diameter; stele with the trio-type pattern, the phloem on the inner face of the trio-bundle appearing as 2 patches; endodermis of O-cells; interlacunar and subepidermal bundles absent; pseudo-hypodermis 1 cell thick, at least partly so. LEAVES all submersed, coarse, mostly ovate-lanceolate, often ovate at the lower part of the stem and becoming narrowly lanceolate above, (1.5–) 3–10 cm. long, (.5–) 1–2 cm. wide, nerves (7–) 17–29 (–33), all rather prominent, 3–7 of them more prominent than the others, cordate at base and clasping $\frac{1}{2}$ or $\frac{3}{4}$ the circumference of the stem; apex acutish but never sharp-pointed, sometimes rounded; margin with fugacious 1-celled translucent denticles, which are usually more or less appressed, lacunae of 2 or 3 rows of cells each side of the midrib. STIPULES whitish, coarsely nerved, ovate to lanceolate, obtuse when young, 1–2 cm. long, without keels, early disintegrating into whitish fibers. PEDUNCLES at base about same thickness as stem, often clavate, 1.5–25 cm. long. SPIKES with 6–12 whorls, not crowded at anthesis, sometimes moniliform; in fruit 1.5–4 cm. long, and about 1 cm. thick. FLOWERS sessile or on pedicels up to .5 (–1) mm. long; sepaloid connectives greenish, blades orbicular or elliptical, (1.3–) 1.4–2 (–2.3) mm. wide, claws usually 1–1.5 mm. long; anthers (.8–) 1.1–1.3 (–1.4) mm. long. FRUITS obovate, rounded on the back and at the base, sides plump or with a shallow depression, (2.5–) 2.7–3.2 (–3.5) mm. long (excluding beak), (2–) 2.3–2.6 (–3) mm. wide; beak prominent, up to 1 mm. long; keels rounded or none, rarely acutish; exocarp usually gray-green or olive-green; endocarp with rounded keels, beak linear, facial, about .8 mm. long, loop with a cavity, or at least a weak area; apex of seed pointing toward the basal end or slightly above. Plants characterized by numerous coarsely-nerved perfoliate submersed leaves, with stipules persistent as whitish fibers.

P. Richardsonii (Benn.) Rydb., Bull. Torr. Club **32**: 599 (1905). *P. perfoliatus* var. *lanceolatus* Robb. in Gray, Man. ed. 5: 488 (1867); not Blytt (1861). *P. perfoliatus* var. *Richardsonii* Benn., Journ. Bot. **27**: 25 (1889); Morong, Mem. Torr. Club **3**: no. 2: 33 (1893); Graebn. in Engler, Pflanzenr. **4**: fam. 11: 95 (1907). *P. perfoliatus* L. sensu Taylor, N. Am. Fl. **17**: pt. 1: 22 (1909), in part; sensu Hultén, Fl. Alaska & Yukon 101 (1940). *P. perfoliatus* var. *gracilis* sensu Fernald in Porsild, RHODORA **41**: 176 (1939). *Spirillus perfoliatus* var. *Richardsonii* (Benn.) Nieuwl., Am. Mid. Nat. **3**: 17 (1913). *P. perfoliatus* ssp. *Richardsonii* Hultén, Fl. Alaska & Yukon 102 (1940).

Deep water of lakes and rivers, Labrador, Quebec, northern Maine, Vermont and western Massachusetts, west to Utah and California, north to British Columbia, Mackenzie, Alaska and the Aleutian Islands. MAP 15.

(To be continued)

THE SENECIO ON THE COASTAL DUNES OF TEXAS

V. L. CORY¹

At various times my friend and co-worker, Mr. H. B. Parks, has told me about a different *Senecio* growing on the coastal islands of Texas and has sent me specimens from various places. His material from Flour Bluff near Corpus Christi, collected October 18, 1936, caused me to draft a preliminary description of the plant and, even now, the type specimen is designated as No. 27538, which is of that collection. This specimen is deposited at the Gray Herbarium. However, in November, 1940, it was my privilege to visit, in the pleasurable company of Mr. Parks, the area in which this plant grows and to collect the plant myself at Del Mar, Boca Chica, at the mouth of the Rio Grande, along Red Fish Bay in Willacy County, and on Padre Island in Kleberg County. Representative material of these collections have been sent to various herbaria. To me this plant is closely associated with my companion of this trip, and I take pleasure in naming it in his honor.

SENECIO RIDDELLII T. & G., var. **Parksii**, new var. Plant perennial, suffruticose, glabrous, 1 meter high or less, and the spread frequently equalling the height; stems more or less woody, 1 cm. broad more or less at the base, diffusely branched; branches ascending-spreading, very leafy; leaves succulent, drying brown or black, up to 10 cm. long and 8 cm. broad, pinnately divided into 5-9 linear, elongate, entire divisions, which are acute and as much as 5 cm. long and 3.5 mm. broad; heads 12 mm. high and about as broad, radiate, in a compound corymb, each branch of the stem usually with 20 heads or more; branches of the inflorescence axillary; peduncles 2-4 cm. long, 0.5 mm. broad or less, ascending-spreading, subtended by linear-lanceolate or narrower bracts that are up to 5 mm. long, calyculate with subulate scales, and bearing solitary heads; involucre campanulate, 1 cm. high, calyculate with subulate scales, glabrous; involucre bracts 12-17, linear-lanceolate or broader, scarious-margined; ray-flowers about 8; ligules spatulate, about 9 mm. long and 3 mm. broad; disk-flowers about 35, the corolla-tube 5 mm. long, the throat and limb 4 mm. long; achenes 2 mm. long or slightly more; slender, subterete, hirtellous; pappus copious, white, slightly longer than the corolla of the disk flowers.

SENECIO RIDDELLII T. & G., var. **Parksii**, var. nov. Planta

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perennis, suffruticosa, glabra, ad 1 m. alta, saepius totidem lata; caulibus plus minusve lignescentibus, basi minusve 1 cm. crassis, valde ramosis; ramis adscendenti-patentibus valde foliosis; foliis carnosis, in sicco brunneis vel nigris, ad 10. cm. longis, 8 cm. latis, in lobos 5-9 lineares, elongatos, integros partitis, lobis acutis, ad 5 cm. longis, 3.5 cm. latis; capitulis 12 mm. longis totidemque latis, radiatis, in corymbo composito ordinatis, in ramulo quove ca. 20; inflorescentiae ramulis axillaribus; pedunculis 2-4 cm. longis, 0.4 mm. latis vel minoribus, flore singulo terminatis, patenti-adscendentibus, bracteis lineari-lanceolatis vel angustioribus ad 5 mm. longis, bracteis subulatis calyculantibus; involucris campanulatis, 1 cm. longis, bracteis subulatis calyculantibus, glabris; bracteis involucralibus 12-17, lineari-lanceolatis vel majoribus, margine scariosis; floribus radialibus ca. 8; ligulis spathulatis, ca. 9 mm. longis, 3 mm. latis; floribus centralibus ca. 35, tubo 5 mm. longo, fauce cum limbo 4 mm. longis; acheniis 2 mm. longis vel paulo majoribus, gracilibus, subteretibus, hirtulis; pappo copioso, albo corallam florum centralium parum excedente.¹

The species and its variety are widely separated geographically and also in the elevation of their habitats. To my knowledge the two plants come closest together in the occurrence of the species at the base of Iron Mountain in Brewster County and of the variety on the coastal dunes in the vicinity of Corpus Christi, or 550 miles or more apart on a straight line. Roughly the elevations of these two localities are 4650 feet and 50 feet. One would suspect that neither one of these plants could grow in the habitat of the other. For the most part in Texas the species grows scatteringly in grass-lands of the High Plains and extends southward into the Trans-Pecos Area, where in recent years it has become wide-spread and has increased most markedly in abundance at elevations exceeding 4100 feet, as noted in driving down Limpia Canyon in the Davis Mountains recently, while the variety grows in extensive and frequently dense stands on dunes of the coastal islands and the adjacent mainland, in which places the grass-cover is deficient or lacking. On casual observation the variety suggests *S. longilobus*, and it does not suggest *S. Riddellii* due to their difference in habit of growth. The species has a plant consisting of a clump of several erect stems, except in the inflorescence not branched above the base,

¹ I wish to express grateful acknowledgment to Dr. Leon Croizart for valuable assistance given in the preparation of the latin description.

while the variety is a plant consisting of a single stem, diffusely branched throughout. The variety has succulent foliage, and the leaves and their divisions are larger than in the species. The plant dries green in the species and brown or black in the variety, and the growth above the base tends to become woody in the variety and remains herbaceous in the species. The two plants seem to merit some sort of separation botanically.

Both Dr. S. F. Blake and Dr. J. M. Greenman recognize this plant as *Senecio Riddellii*, and I am deeply indebted to them for their courteous assistance. Type specimen is designated as No. 27538, which was collected by H. B. Parks, October 18, 1936, at Flour Bluff, a place which no longer exists, for the dunes were razed to provide for the site of the U. S. Naval Training Station at Corpus Christi. The type specimen is deposited at the Gray Herbarium.

May we tell a story of this plant-collecting trip? The mouth of the Rio Grande is two miles below Boca Chica, or three miles below Del Mar. Mr. Parks and I drove on the hard-packed wet sand of the beach down to near the mouth of the river, and parked the car higher up in the edge of the dry sand while exploring the dunes for plants. Our vehicle was a new truck on its first trip. In backing out of the dry sand the car came to rest in the edge of the water with the right rear wheel lodged in the fork of a tree-trunk buried in the sand and it soon became obvious that we were helpless to move the truck either forward or backward. Soon it became dark and the tide was coming in, and we did not know how high it might rise; so we moved the load of plant specimens to a near-by dune and built a rousing bonfire from drift wood. We figured on saving the plant specimens at any rate. Then we sat in the car and enjoyed the bright moonlight on the waters of the Gulf of Mexico and wondered somewhat if the water would rise high enough to wash our car away. My wife, who had become alarmed at our failure to return to camp at Brownsville, twenty-six miles from Boca Chica, came out about midnight and sponsored a relief party which was successful; we took our supper at one o'clock in the morning at Brownsville and were thankful that at least one cafe there remained open all night. This story is in memory of our visit to the mouth of the Rio Grande.

CAREX FLEXUOSA IN MINNESOTA.—The finding of *Carex flexuosa* Muhl. ex Willd. (= *C. debilis* Michx. var. *Rudgei* Bailey¹) in Minnesota represents an extension of the known range according to published accounts and data available at the University of Minnesota Herbarium. This sedge was collected October 11, 1941, growing on fine sandy loam in an oak forest. It was found on a very gentle slope within 50 feet of a small swamp. *C. gracillima* Schwein., *C. scoparia* Schkuhr ex Willd., and *C. pennsylvanica* Lam. were found growing nearby. This collection of *C. flexuosa* was made about one-half mile south of Rice Lake in Section 29, T31N, R22W, in southern Anoka County, Minnesota, P. L. 170. The specimens gathered were examined and my identification was sustained by Doctors C. O. Rosendahl, F. K. Butters, and John W. Moore, of the University of Minnesota.

On June 4, 1942, Dr. Moore, to whom I am also indebted for valuable help in exploring the available data on this sedge, accompanied me on a special trip to the locality for the purpose of making an additional check on the species. We found *C. flexuosa* with its perigynia practically full-grown and a set of identifiable specimens was obtained. Specimens of the associated species *C. gracillima*, *C. scoparia*, *C. pennsylvanica*, and *C. brunnescens* (Pers.) Poir. were also collected.

The culms of the *C. flexuosa* plants gathered in the fall were about one meter tall, while those collected in June were about half this height. Both collections (P. L. 170 and P. L. 205), as well as the other species mentioned, have been deposited in the University of Minnesota Herbarium.

The nearest previous report for *C. flexuosa* was in Wisconsin.² A closely related species, *C. debilis* Michx. var. *pubera* A. Gray (= *C. allegheniensis* Mackenzie), has been erroneously reported for Minnesota.³ At the suggestion of Dr. M. L. Fernald the specimen in the United States National Herbarium was checked by Dr. Frederick J. Hermann and found to be *C. assiniboinensis* W. Boott, a common resident of Minnesota.—PAUL C. LEMON, University of Minnesota.

¹ Hermann, Frederick J. The genus *Carex* in Indiana. In C. C. Deam, *Flora of Indiana*, page 255. 1940.

———. The genus *Carex* in Michigan. *American Midland Naturalist*, 25: 47–48. 1941.

² Fernald, M. L. Critical notes on *Carex*. *RHODORA*, 44: 310. 1942.

³ Minnesota Botanical Studies, 1: 528. 1896.

SCIRPUS PECKII IN CANADA.—The handsome and very distinct *Scirpus Peckii* Britton has heretofore been known only from a limited area, from Somerset County, Maine, to Franklin and Oswego Counties, New York, thence south, very locally, to southwestern New Hampshire, western Massachusetts, northwestern Connecticut, and the Catskill region of southeastern New York. Since at Sutton, Vermont, and at Loon Lake, Franklin County, New York, it is within 30 miles of the Canadian border, it has been natural to suppose that it might get into southwestern Quebec and extreme eastern Ontario. This expectation is partly fulfilled, for I find in the covers of *S. cyperinus* in the Gray Herbarium a very characteristic sheet of flowering *S. Peckii* collected July 23, 1926, at Bellerive, Beauharnois County, Quebec, by Frère Vincent and sent out by Fr. Adrien as no. 1-235. This station is about 50 miles north of Loon Lake.—M. L. FERNALD.

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